New York State Department of Environmental Conservation
Division of Hazardous Substance Regulation, Suite 202
615 Erie Blvd. West, Syracuse, NY 13204-2400
(315) 426-7551

Langdon Marsh
Commissioner

January 26, 1995

Mr. Paul Wagner, P.E.
Director, Environmental Safety & Industrial Hygiene
Bristol-Myers Squibb Company
Bio-Chem Division
PO Box 4755
Syracuse, New York 13221-4755

Re: Site Contamination Study - **Revised** Report
Multimedia Order On Consent

Dear Mr. Wagner:

The New York State Department of Environmental Conservation (NYSDEC) has approved the referenced Report, resubmitted by Bristol-Myers Squibb (B-MS) on November 9, 1994. B-MS had submitted the draft Report on June 23, 1994, pursuant to the Multimedia Order on Consent between B-MS and the NYSDEC signed on July 8, 1993. The revised Report addresses NYSDEC's comments of September 26, 1994 and the issues discussed at a meeting between the Department and B-MS on October 14, 1994.

We are also enclosing a letter approving the Storm Sewer Contaminant Source Investigation Summary Report. That Report was submitted pursuant to the requirements of SPDES Permit No. NY 023 3251.

Please contact Mohamed Yasin at 426-7551, if you have any questions.

Sincerely,

Steven P. Eidt, P.E.
Regional Hazardous Substances Engineer
Region 7

cc: William L. McGarry, Jr. (B-MS)
F. J. Wound (B-MS)
Joseph M. Kowalczyk, Jr. (NYSDEC)
William F. Eberle (NYSDEC)
Angus Eaton (Attn: R. Wither, NYSDEC)
Lee Flocke (Attn: K. Kenty, NYSDEC)

Enc.

SITE CONTAMINATION STUDY REPORT
Thompson Road Facility, Syracuse, New York

PREPARED FOR:

BRISTOL - MYERS SQUIBB COMPANY
BIO / CHEM DIVISION
Syracuse, New York

PREPARED BY:

ES
ENGINEERING-SCIENCE
Liverpool, New York

NOVEMBER 1994

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SITE CONTAMINATION STUDY REPORT
THOMPSON ROAD FACILITY
SYRACUSE, NEW YORK

Prepared for:

BRISTOL-MYERS SQUIBB COMPANY
BIO/CHEM DIVISION
SYRACUSE, NEW YORK

Prepared by:

ENGINEERING-SCIENCE, INC.
290 ELWOOD DAVIS ROAD
LIVERPOOL, NEW YORK 13088

November, 1994

Reviewed and Approved by:

Project Manager

Technical Director

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EXECUTIVE SUMMARY

PROJECT BACKGROUND

On July 8, 1993, Bristol-Myers Squibb Company (BMS) entered into a Multi-Media Consent Order and Memorandum of Understanding with the New York State Department of Environmental Conservation (NYSDEC). Under Paragraph I of the Multi-Media Consent Order, BMS is to perform a Site Characterization Study. The Site Characterization Study consists of two parts: a Site Contamination Study and a Site Investigation and Remediation Study (SIRS). In accordance with Paragraph I (A)(1)(a) of the Order, the Site Contamination Study is to summarize the history of the facility operations and the known hydrogeologic and contamination conditions at the site. This report presents results of the Site Contamination Study.

SITE DESCRIPTION

BMS owns and operates a pharmaceutical manufacturing facility located in the Village of East Syracuse and the Town of DeWitt, Onondaga County, New York. The site comprises 34 contiguous parcels totaling 59.5 acres and is bordered by residential, commercial and industrial properties. Over 70 buildings are located at the site providing facilities for two divisions of the company: the Bio/Chem Division and the Pharmaceutical Research Institute (Figure 1).

Pharmaceutical manufacturing activities include fermentation, extraction, splitting and finished bulk operations. The major bulk items produced at the site include Potassium Penicillin V, 7-aminocephalosporanic acid (7-ACA), 6-aminopenicillanic acid (6-APA), Kanamycin and Amikacin. Major solvents or reagents used at the facility include:

Acetone
Ammonia
n-Butyl Alcohol (Butanol)
Methyl Alcohol (Methanol)
Dichloromethane (Methylene Chloride)
Methyl Isobutyl Ketone (MIBK)
Acetonitrile
Ammonium Sulfate
Ethylene Glycol
N,N-Dimethylaniline (DMA)
Sodium Hydroxide
Sulfuric Acid
Toluene
Isopropyl Alcohol (IPA)
Dicyclohexylamine (DCHA)
Dimethyldichlorosilane (DDS)
Potassium Hydroxide
Acetic Acid

PROJECT OBJECTIVES

The objectives of the Site Contamination Study are to:

(1) summarize the chronological history of the facility land use;

(2) summarize the regional and site subsurface geology and hydrogeology from available information;

(3) characterize known soil and groundwater contamination at the site using available data from previous investigations;

(4) identify "Study Areas" at the site where facility operations may have resulted in potential soil or groundwater contamination at levels of environmental concern; and,

(5) prepare a Site Investigation and Remediation Study (SIRS) work plan which shall provide for (i) evaluation of the Study Areas identified in the Site Contamination Study and (ii) characterization of those areas at the site for which there is insufficient information to make a valid engineering judgment as to the presence of contamination at a level of environmental concern.

METHODOLOGIES

The following types of information and data were reviewed and assessed as part of this study:

- Previous reports
- Aerial photographs
- Sanborn fire insurance maps
- Discussions with plant personnel
- BMS spill files
- Environmental and plant engineering files
- Site inspection

GEOLOGY AND HYDROGEOLOGY

The BMS site is located within the Erie-Ontario Plain physiographic province near the Onondaga Limestone Escarpment (USDA, 1977). The stratigraphy of this region is characterized by glacial and postglacial sediments overlying Silurian age bedrock. Groundwater occurs in the glacial deposits and the bedrock.

The geology of the site is characterized by five stratigraphic units: (1) fill, (2) marsh deposits, (3) glacio-lacustrine deposits, (4) glacial till, and (5) Upper Silurian Camillus Shale bedrock. The well logs and water levels indicate that two water bearing units are present at the site: (1) fill/glacio-lacustrine and (2) glacial till. In areas where the low permeability till is deep and thick, it likely acts as a barrier to downward migration of contaminants to the bedrock. The horizontal groundwater flow direction in the fill and glacio-lacustrine deposits and the deeper till are to the east towards Ley Creek. It appears that shallow groundwater discharges directly to Ley Creek.

SITE HISTORY

The first building at the BMS facility was constructed in 1943. Prior to this, the majority of the site was an open field. One building, owned by the National Cellulose Corporation, was located on the eastern portion of the site. This building is now called Building 6.

Historical development of the site began in the northwest corner of the property and expanded to the east and south. Expansion during the 1950's and 1960's was rapid and occurred primarily in the northwestern and northern half of the site adjacent to the existing buildings. During the 1970's expansion occurred in the central and southern portions of the site. Subsequent expansion occurred primarily in the eastern and southern portions of the site. Major production and manufacturing areas expanded over time but have remained in the same locations.

Five historical drum storage areas were identified at the site. The drums likely contained raw materials and chemicals used in the manufacturing process. Drums were stored on the ground surface in these areas. The storage areas were relocated eastwards as the site expanded and new buildings were constructed. With the exception of the drum storage areas, major solvent usage and storage areas were located primarily in the northwest portion of the facility and have remained consistent over time. Types of solvents used have also remained consistent over time.

The southern portion of the site consisted of open fields, residential homes, and parking areas until approximately 1980. The eastern portion of the site remained undeveloped and wooded until 1966. Drum storage areas 3, 4, and 5 were previously located in this area. It is currently occupied by research laboratories and the new tank farm installed in 1988.

SPILLS AND LEAKS

Spill or leak events have occurred at the BMS site. The majority of the documented spills and leaks discharged directly to the sanitary sewer system. A total of eleven significant spill or leak events (greater than 1,000 gallons or directly impacting adjacent soils) were identified in the spill files. All spills or leaks exceeding reportable quantities were reported to the appropriate authorities.

SUMMARY OF GROUNDWATER QUALITY

A total of 42 monitoring wells have been installed at the site between 1989 and 1994. The wells monitor the shallow fill and lacustrine units as well as the deeper till deposits. Groundwater samples have been collected at various times from the site monitoring wells.

Eleven individual volatile organic compounds (VOCs) have been detected in the groundwater beneath the site. Three compounds, MIBK, 1,1-DCA and tetrachloroethylene, were detected at concentrations below the groundwater standards. Four compounds, chlorobenzene, 1,2-dichlorobenzene, 1,1,1-TCA, and 1,2-DCA, were detected at concentrations slightly above the groundwater standards. With the exception of chlorobenzene, these compounds were only detected in one sample from one well. Methanol was detected in one sample from well PW-4LS at a concentration of 990 $\mu g/l$. It was not detected in the subsequent sampling round. Acetone was detected in notch well MW77-2 at a concentration of 190 $\mu g/l$. Tert-butanol was detected in three wells near the Lower Main Tank Farm at concentrations of 130 $\mu g/l$ to 600 $\mu g/l$. Methylene chloride was detected at concentrations exceeding the groundwater standard in wells near the CHT Tank Farm. A dual phase vacuum extraction pilot plant has been installed to remove the methylene chloride detected in soil and groundwater.

The existing groundwater data demonstrates the presence of low levels of a few volatile organic compounds in a limited number of groundwater wells sampled on the site. While Class GA groundwater quality standards or guidance values were slightly exceeded at a limited number of sample locations, available data do not indicate extensive contamination of groundwater beneath the site. In particular, the most commonly used chemicals at the site (acetone, MIBK, methanol and butanol), with the exception of methylene chloride near the CHT Tank Farm, were not detected in the groundwater downgradient of major use areas. While groundwater contamination is present near the CHT Tank Farm, it is limited to a small defined area which is currently undergoing remediation.

Based on the groundwater flow directions, history of the surrounding properties, and existing groundwater analytical data, it is unlikely that significant contaminants have migrated on-site from adjacent properties.

IDENTIFICATION AND EVALUATION OF POTENTIAL SOURCE AREAS

Areas of the site for which the facility operations may have had the potential to impact the soil or groundwater were identified and evaluated. Potential source areas at the site can be grouped into four categories:

(1) Manufacturing and processing areas

Deteriorated sections of the sanitary sewer
Buildings 1 and 4 area
Buildings 9 and 24 area

(2) Chemical storage areas

ST Tank Farm
Upper Main Tank Farm
Lower Main Tank Farm
CHT Tank Farm
Former drum storage areas one through five

(3) Petroleum storage area

Building 18 Fuel Oil UST's

(4) Former coal pile

Existing data suggest that contaminants are not present at a level of environmental concern in the Upper and Lower Main Tank Farm area and former drum storage area 1. Although contaminants are present in soil and groundwater near the CHT Tank

Farm, this area is currently being remediated. Additional data are needed to complete evaluation of the remaining potential source areas.

IDENTIFICATION OF STUDY AREAS

Seven Study Areas were identified which require additional information to determine the presence or absence of contamination at levels of environmental concern. These include:

1. Deteriorated sections of the sanitary sewer system (includes areas in the vicinity of Outfalls 002 and 009)
2. The Building 1 and 4 areas
3. The Building 9 and 24 areas
4. The ST Tank Farm
5. Former drum storage areas 2, 3, 4, 5
6. Former underground fuel oil storage tanks near Building 18
7. The former coal pile

CONCLUSIONS

Based on results of the Site Contamination Study, the following conclusions can be made:

- Historical development of the site began in the northwestern corner and expanded to the east and south. Major solvent usage areas were located in the northwest portion of the site and have remained in the same locations through time.
- No potential source areas or Study Areas are located in the southern portion of the site. This area consisted of open fields, residential homes, and parking areas until approximately 1980. It is currently occupied by administrative, receiving and traffic control, and research buildings.
- Five historic drum storage areas were identified at the site. Drums of chemicals were temporarily stored on the ground surface in these areas until they were used in the manufacturing process. The storage areas were relocated to the east as the site expanded.
- Available data do not indicate extensive contamination of groundwater beneath the site. In particular, the most commonly used chemicals at the site (acetone, MIBK, methanol, and butanol), with the exception of methylene chloride near the CHT Tank Farm, were not detected in the groundwater downgradient of major use areas. Where groundwater contamination is present near the CHT Tank Farm, it appears to be localized to a small area.
- The dual phase vacuum extraction pilot plant has proven to be capable of removing methylene chloride from the impacted area near the CHT Tank Farm. Since start-up, approximately 1,100 pounds of methylene chloride have been

removed. In addition, groundwater sampling indicates that the methylene chloride concentrations in the most contaminated extraction well, CH-2T, have decreased by an order of magnitude from an initial level of 13,200 mg/l to 1,900 mg/l in November 1993.

- Seven Study Areas have been identified which require additional information to determine the presence of contamination at levels of environmental concern. These include:

  1. Deteriorated sections of the sanitary sewer system (Includes areas in the vicinity of Outfalls 002 and 009)
  2. Building 1 and 4 area
  3. Building 9 and 24 area
  4. ST Tank Farm
  5. Former drum storage areas 2, 3, 4, 5
  6. Building 18 Fuel Oil USTs
  7. Former coal pile

- Groundwater data will be collected from four of the study areas as part of the Storm Sewer Contaminant Source Investigation. This information will be included in the SIRS report.

RECOMMENDATIONS

The following recommendations are made based on the data evaluated as part of this study:

1. Collection of two complete rounds of groundwater level measurements from all site wells is recommended to better characterize the groundwater flow systems and determine seasonal fluctuations.

2. Additional groundwater analytical data are needed from the seven study areas to determine if contamination may be present at levels of environmental concern. Data will be collected from four of the study areas during the Storm Sewer Contaminant Source Investigation and will be incorporated into the SIRS. The other Study Areas will be investigated during the SIRS. Groundwater samples will be obtained in each study area by using the Geoprobe or Hydropunch system. Samples may be analyzed using an on-site mobile laboratory unit equipped with a temperature-programable gas chromatograph or placed in a laboratory cooler, packed on ice and shipped overnight to a laboratory. Results from the groundwater samples will be used to assess the potential presence of a source area and the need, if any, for additional groundwater and soil sampling.

- Groundwater samples collected from the manufacturing and process areas, the chemical storage areas, and near the deteriorated sanitary sewers should be analyzed for parameters listed in Storm Sewer Contaminant Source Investigation Study.

- Groundwater samples from the petroleum storage area should be analyzed for BTEX and TCL semivolatile organic compounds.
- Groundwater samples from the former coal pile area should be analyzed for TCL semivolatile organic compounds.
- Number of samples and sample locations are presented in Section 4, the Site Investigation and Remediation Study Work Plan.

FIGURE 1

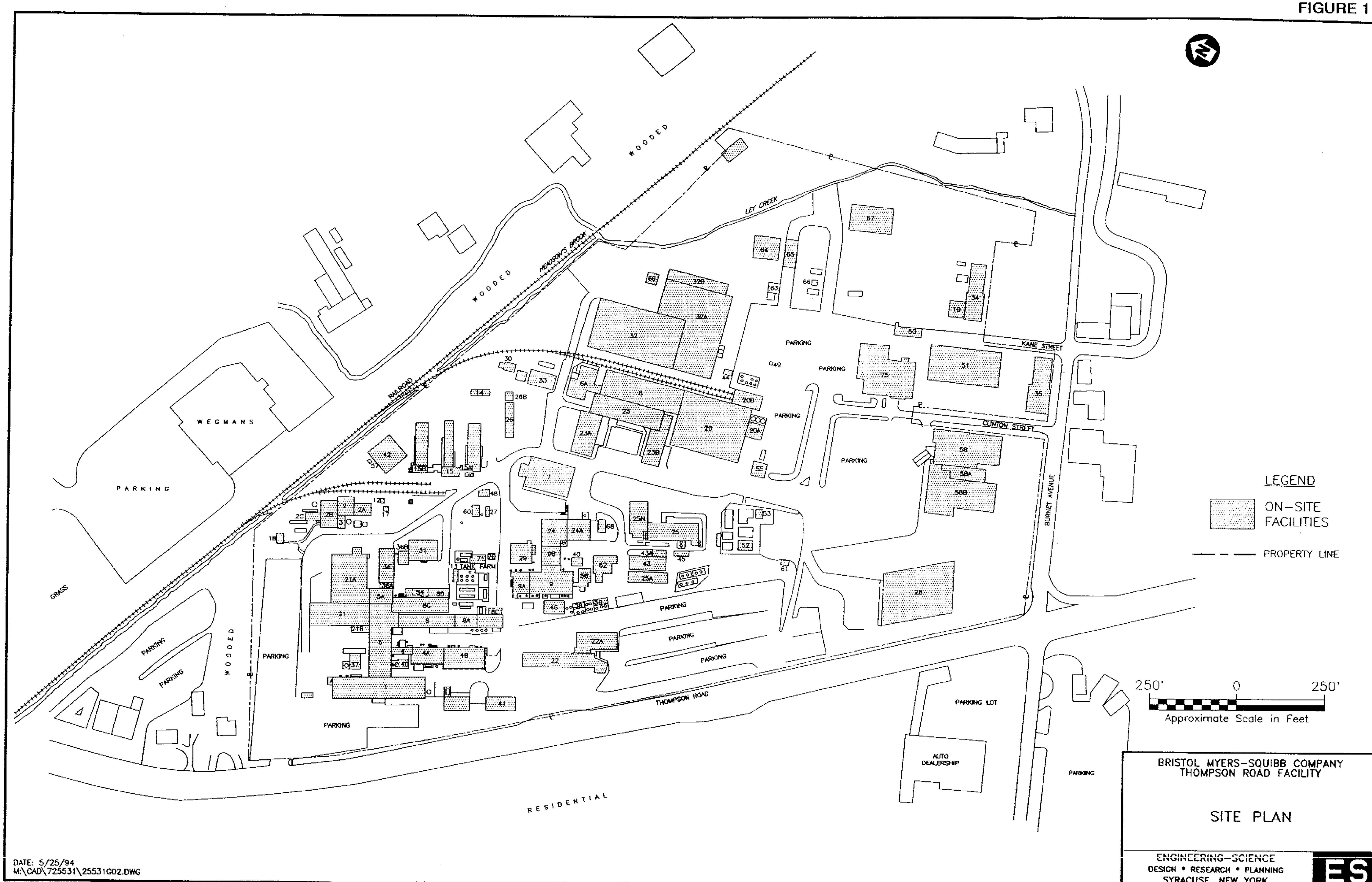
WOODED
WEGMANS
PARKING
GRASS
RAILROAD
HEADSON'S BROOK
LEY CREEK
KANE STREET
CLINTON STREET
BURNET AVENUE
THOMPSON ROAD
RESIDENTIAL
PARKING LOT
AUTO DEALERSHIP
TANK FARM
LEGEND
ON-SITE FACILITIES
PROPERTY LINE
250' 0 250'
Approximate Scale in Feet
BRISTOL MYERS-SQUIBB COMPANY
THOMPSON ROAD FACILITY
SITE PLAN
ENGINEERING-SCIENCE
DESIGN • RESEARCH • PLANNING
SYRACUSE, NEW YORK
ES
DATE: 5/25/94
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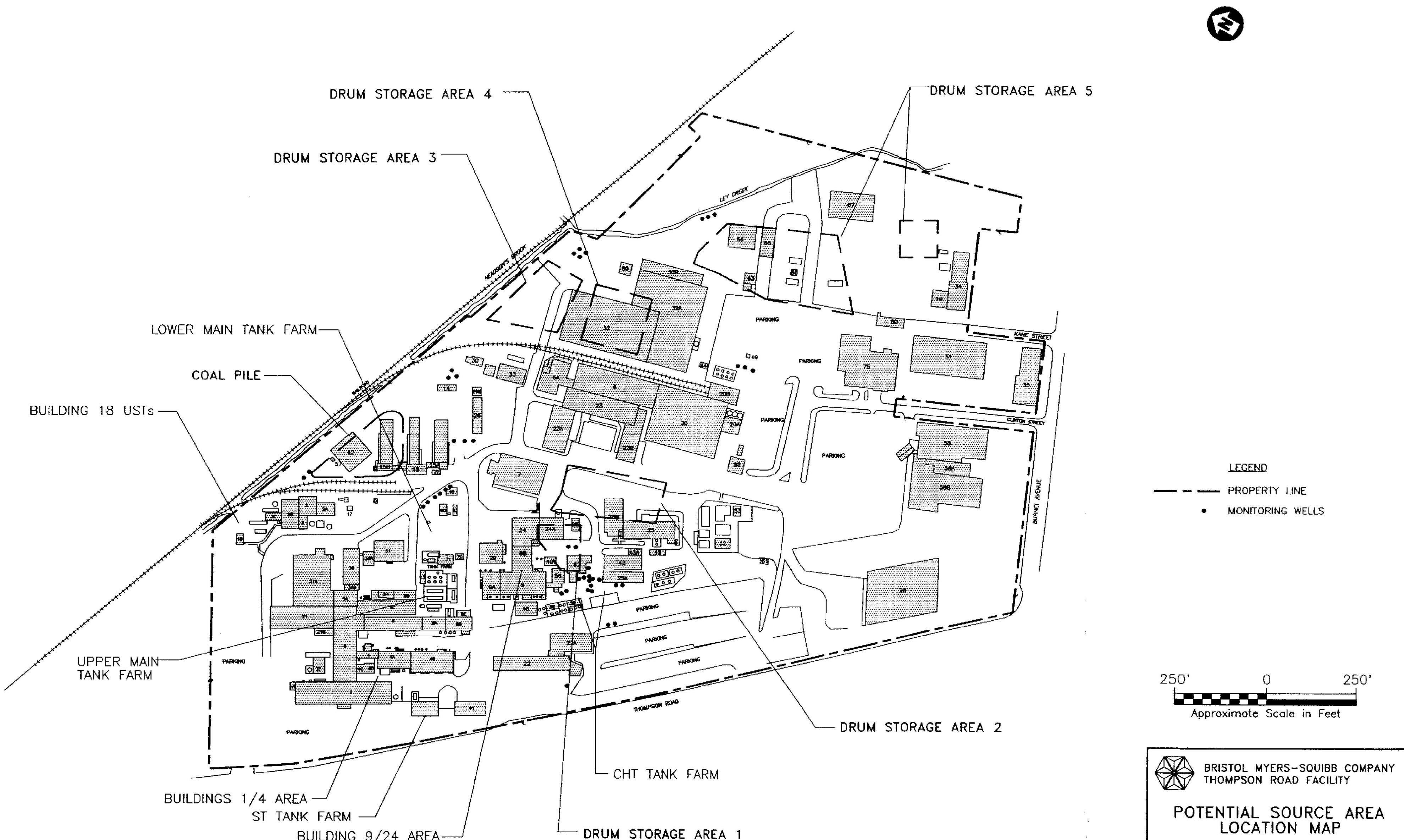
FIGURE 2



BRISTOL MYERS-SQUIBB COMPANY
THOMPSON ROAD FACILITY

POTENTIAL SOURCE AREA LOCATION MAP

ENGINEERING-SCIENCE
DESIGN • RESEARCH • PLANNING
SYRACUSE, NEW YORK

ES

DATE: 5/26/94
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SECTION 1

INTRODUCTION

1.1 PROJECT BACKGROUND

On July 8, 1993, Bristol-Myers Squibb Company (BMS) entered into a Multi-Media Consent Order and Memorandum of Understanding with the New York State Department of Environmental Conservation (NYSDEC). Under Paragraph I of the Multi-Media Consent Order, BMS is to perform a Site Characterization Study. The purpose of the Site Characterization Study is to characterize soil and groundwater contamination and to identify appropriate remedial and/or corrective actions to address any contamination at levels of environmental concern.

The Site Characterization Study consists of two parts: a Site Contamination Study and a Site Investigation and Remediation Study (SIRS). The Site Contamination Study report was submitted to the NYSDEC on July 8, 1994. In accordance with Paragraph I (A)(1)(a) of the Order, the Site Contamination Study summarizes the history of the facility operations and the known hydrogeologic and contamination conditions at the site. This report presents results of the Site Contamination Study.

1.2 SITE DESCRIPTION

1.2.1 Site Location

BMS owns and operates a pharmaceutical manufacturing facility located in the Village of East Syracuse and the Town of DeWitt, Onondaga County, New York. The site is situated on the east side of Thompson Road approximately a quarter of a mile northwest of the intersection with Interstate 690 (Figure 1.1). The site is bordered by Thompson Road and residential properties on the west. An animal hospital and Syracuse New Channels office is located to the north. Conrail Railroad tracks and Headson's Brook border the northeast side of the site. The south branch of Ley Creek and the former Fulton Iron and Steel scrap yard are located to the east. Burnet Avenue and an automobile repair shop are located along the southern border of the facility.

1.2.2 Facility Description

The BMS site comprises 34 contiguous parcels totaling 59.5 acres. Over 70 buildings are located at the site providing facilities for two divisions of the company: the Bio/Chem Division and the Pharmaceutical Research Institute (Figure 1.2). The Bio/Chem Division facilities consist of pharmaceutical manufacturing, quality control and research laboratories, pilot plants and administrative offices. Pharmaceutical manufacturing activities include fermentation, extraction, splitting and finished bulk operations. Major solvents or reagents used at the facility include:

Acetone
Ammonia
n-Butyl Alcohol (Butanol)
Methyl Alcohol (Methanol)

Dichloromethane (Methylene Chloride)
Methyl Isobutyl Ketone (MIBK)
Acetonitrile
Ammonium Sulfate
Ethylene Glycol
N,N-Dimethylaniline (DMA)
Sodium Hydroxide
Sulfuric Acid
Toluene
Isopropyl Alcohol (IPA)
Dicyclohexylamine (DCHA)
Dimethyldichlorosilane (DDS)
Potassium Hydroxide
Acetic Acid

The locations of current outside bulk storage and process tanks are shown on Figure 1.3 and listed in Table 1.1. The manufacturing operations produce primarily intermediate bulk antibiotics and other pharmaceutical compounds which are shipped outside the facility for final processing into finished product forms. The major bulk items produced at the site include Potassium Penicillin V, 7-aminocephalosporanic acid (7-ACA), 6-aminopenicillanic acid (6-APA), Kanamycin and Amikacin.

The Pharmaceutical Research Institute facilities consist primarily of research laboratories. Various chemicals are used in the research facilities in small quantities.

1.3 PROJECT OBJECTIVES

The objectives of the Site Contamination Study, in accordance with the Consent Order, are to:

(1) summarize the chronological history of the facility land use;

(2) summarize the regional and site subsurface geology and hydrogeology from available information;

(3) characterize known soil and groundwater contamination at the site using available data from previous investigations;

(4) identify "Study Areas" at the site where facility operations may have resulted in potential soil or groundwater contamination at levels of environmental concern; and,

(5) prepare a Site Investigation and Remediation Study (SIRS) work plan which shall provide for (i) evaluation of the Study Areas identified in the Site Contamination Study and (ii) characterization of those areas at the site for which there is insufficient information to make a valid engineering judgment as to the presence of contamination at a level of environmental concern.

1.4 REPORT ORGANIZATION

This report documents the results of the Site Contamination Study. The Site Contamination Study was performed in accordance with provisions of July 1993 Multi-Media Consent Order. The report is organized into the following sections:

Section 1 - Introduction: This section presents the project background, site description, project objectives, and methodologies.

Section 2 - Site Characterization: This section presents a summary of the site geology and hydrogeology, the site history, results of BMS file reviews, a summary of previous investigations, a summary of the groundwater quality. This section also identifies potential source areas and Study Areas requiring additional information.

Section 3 - Conclusions and Recommendations: This section presents conclusions and recommendations based on the findings of this report.

Section 4 - SIRS Work Plan: The work plan presents a proposed scope of work, rationale, and methods to be used for collecting data to complete characterization of the Study Areas where insufficient information exists to make a valid engineering judgment as to the presence of contamination at a level of environmental concern.

Appendix A - Field Sampling Plan

Appendix B - Quality Assurance Project Plan

Appendix C - Health and Safety Plan

Appendix D - References

Appendix E - Summary of Storm Sewer Contaminant Source Investigation

Appendix F - Laboratory Results

Appendix G - Topographic Map of the Site

1.5 METHODOLOGIES

To accomplish the objectives outlined in the Consent Order, various types of information and data provided by BMS were reviewed and assessed. These data were used to characterize the site geology and hydrology, to develop a chronological history of the site, to identify major spills and leaks, to summarize the previous investigations, and to summarize the groundwater quality. The results were used to identify study areas.

<u>Previous Reports</u>

Available reports for previous investigations conducted at the facility were reviewed to develop a comprehensive understanding of the known geohydrology, extent of contamination at the facility, and status of any remedial programs. Drilling logs from existing monitoring wells and cross-sections were reviewed to characterize the subsurface geology of the site. Existing groundwater level measurements were used to generate contour maps to characterize the hydrology, groundwater flow directions, and potential contaminant transport directions. Groundwater and soil analytical data were used to characterize the extent of known contamination, potential source areas, and the effectiveness of any current remedial systems.

Aerial Photographs

Various types of aerial photographs of the facility were acquired for this study. Low altitude side view photographs were acquired for the years 1943, 1946, 1947, 1948, 1949, 1953, 1960, 1964, and 1966. Vertical overhead photographs were acquired for the years 1951, 1959, 1966, 1967, 1972, 1978, 1981, 1985, and 1988. These photographs were enlarged to a 1":100' or 1":200' scale. Sources of the photographs are listed in Table 1.2. A 1938 aerial photograph could only be viewed at the Onondaga County Soil Conservation Survey office.

The photographs were reviewed for on-site and surrounding land use, excavations or filling, changes in land use over time, and location of chemical storage areas. This information was used to develop a chronological history of the facility development and land use history. Standard aerial photographic review techniques as specified in the American Society of Photogrammetry, Manual of Photographic Interpretation and Manual of Remote Sensing were used to review the photographs.

Sanborn Fire Insurance Maps

The Syracuse University Library microfilm files containing Sanborn Fire Insurance Maps were reviewed for historical information about the site. A Sanborn map of the site from 1956 was located and reviewed. This information was incorporated into the site history.

Discussions With Plant Personnel

Following the initial data review efforts, an interview was conducted with Mr. Harold Doing and Mr. Joseph Juszkiewicz on April 4, 1994. The purpose of the interview was to verify the information obtained from the aerial photographs and file reviews and to provide any additional pertinent information regarding the site history.

BMS Spill Files

Formal BMS spill files exist for the years 1984 through 1993. These files were reviewed for information on the releases of hazardous substances to the environment, location of the release, quantity of material released, media impacted, and the remedial measures taken.

Environmental and Plant Engineering Files

Available files from the environmental group and from plant engineering were reviewed for information pertaining to the history of the facility operations, dates of building construction and use, dates of tank installation or removal, soil removal projects and any available analytical data.

Site Inspection

Following the initial data review, a site inspection was conducted on March 31, 1994. Major manufacturing and process areas, chemicals storage areas, and past spill areas were examined.

TABLE 1.1
BRISTOL-MYERS SQUIBB COMPANY
THOMPSON ROAD FACILITY

OUTSIDE BULK STORAGE & PROCESS TANK INDEX

Tank Number	Volume (gallons)	Contents
Oil-1	20,000	Nol 6 Fuel Oil
Oil-2	30,000	Nol 6 Fuel Oil
W-37	900	Potassium hydroxide
BS-1	1,500	Polyethylene Glycol
[redacted]		
C-8	750	Water cond.
[redacted]		
T-26	10,000	Acetic Acid
T-67	10,000	Lard oil
T-68	3,000	Lard oil
CS-22	15,000	Butanol
CS-43	10,000	Butanol
CS-44	10,000	MIBK
CS-45	15,000	MIBK
CS-46	15,000	MIBK
CS-47	10,000	Methanol
CS-48	10,000	Methanol
CS-49	5,000	HMDSO
CS-50	29,337	Sulfuric acid
CS-51	29,337	Sodium hydroxide
T-20	10,000	Potassium hydroxide
T-19X	10,000	DCHA
T-60	30,000	CEPH Broth
T-61	10,000	Anhydrous ammonia
[redacted]		
DS-34	1,000	Diesel
[redacted]		

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TABLE 1.1 cont.
BRISTOL-MYERS SQUIBB COMPANY
THOMPSON ROAD FACILITY

OUTSIDE BULK STORAGE & PROCESS TANK INDEX

[redacted]		
M-5	3,000	Gasoline
[redacted]		
T-69	8,000	Hot water
T-71	12,000	Lard oil
T-70	5,000	Sodium hydroxide
DS-55	300	Diesel
T-17	1,200	Aqueous Ammonia
T-16	1,000	IPA/acetone
T-15	650	Aqueous Ammonia
T-7	550	Hydrog/ tole/ pol
VE-1	25,000	MIBK
VE-2	25,000	Water - MIBK
T-8	25,000	Methanol/ Methylene chloride
T-9	25,000	Methanol/ Methylene chloride
VE-3	25,000	Reclaimed POAC
VE-4	25,000	DMA/ DCHA
VE-5	25,000	DMA/ DCHA
CHT-7	10,000	Sodium Hydroxide
CHT-8	10,000	MIBK
CHT-9	10,000	Methylene chloride
CHT-10	10,000	Methylene chloride
CHT-11	10,000	Methylene chloride
CHT-12	10,000	DMA
CHT-13	10,000	DMA
CHT-14	10,000	Empty
CHT-15	10,000	Polyethylene Glycol
CHT-16	10,000	Sulfuric acid
CHT-17	10,000	DDS
N-1	11,000	Liquid nitrogen
N-2	11,000	Liquid nitrogen
H-4	2,000	Acetone
HE-1	3,500	Acetone/ methanol
HE-4	3,500	Acetone/ methanol
BS-24	3,000	methanol

TABLE 1.1 cont.
BRISTOL-MYERS SQUIBB COMPANY
THOMPSON ROAD FACILITY

OUTSIDE BULK STORAGE & PROCESS TANK INDEX

T1-F	4,000	Methylene chloride
K-29	7,500	Methanol
K-7	5,200	Aqueous Ammonia
K-50	3,000	Aqueous Ammonia
K-38	2,000	Aqueous Ammonia
T-90	2,000	Split solvent
T-91	2,000	Split solvent
T-92	2,000	Split solvent
V-18S	7,000	Broth
V-18N	7,000	Broth
K-8	7,000	Methanol/ ammonium hydroxide
K-28	3,000	Methanol
K-27	3,000	Ammonium hydroxide
K-2	6,000	Broth/ Ammonium hydroxide
K-1	7,500	Broth/ Ammonium hydroxide
V-33A	500	Process solvent
V-79A	500	Process solvent
T-1B	4,000	MIBK
T-2B	4,000	CEPH broth
T-3B	4,000	CEPH broth/ MIBK
T-4B	4,000	n-Butanol
C-4A	4,000	Water conditioner
V-2X	4,000	Spent solvent
BS-4B-1	1,500	Polyethelene glycol
BS-4B-2	3,500	Polyethelene glycol
T-4	2,000	Penn broth
BS-1	1,500	Polyethelene glycol
K-2	9,000	Ammonium sulfate
K-3	9,000	Ammonium sulfate
K-4	12,000	Syrup
K-5	12,000	Syrup
V-3X	2,000	BuOH
V-5	1,500	Isopropyl alcohol/ acetone

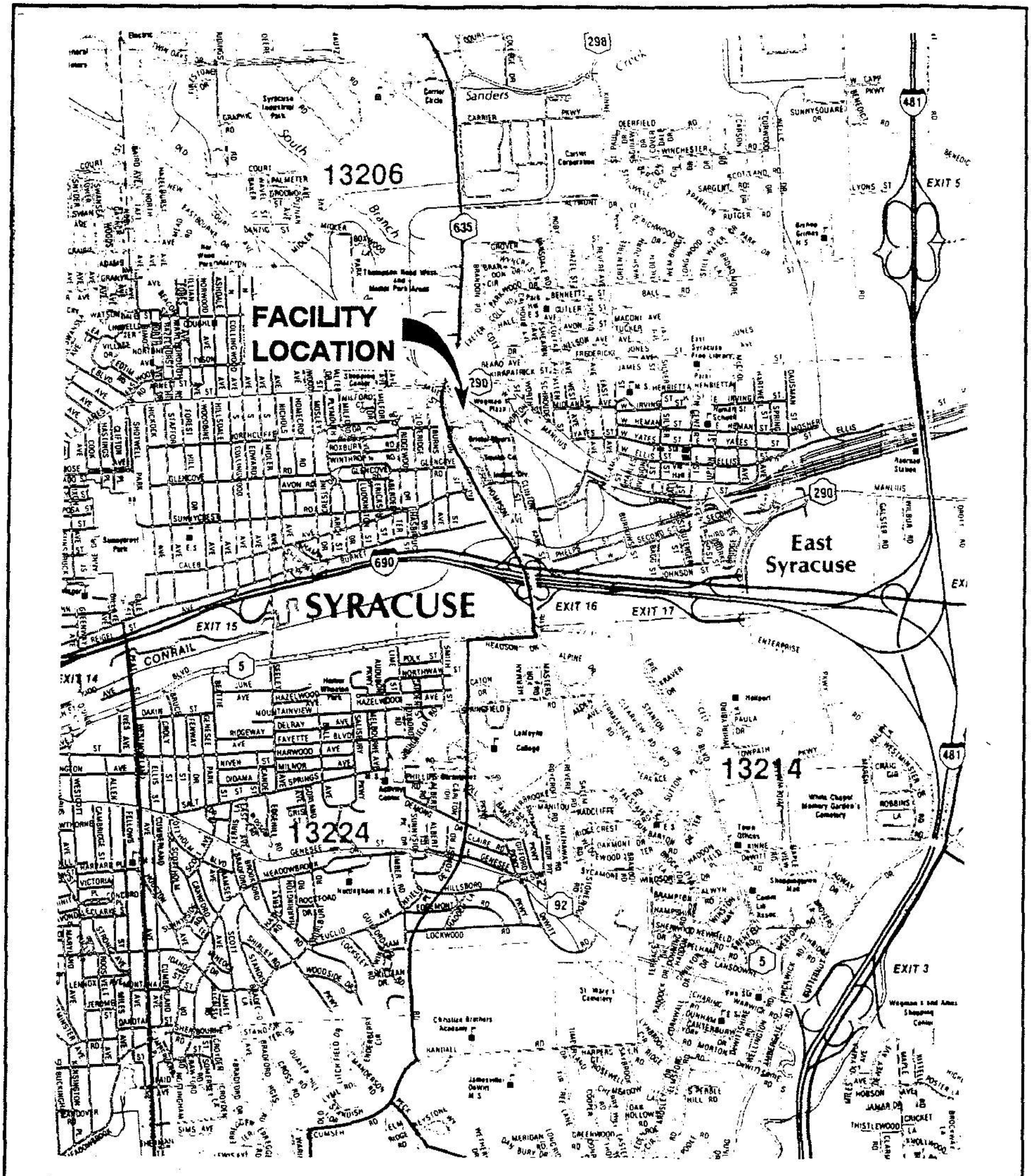
TABLE 1.1 cont.
BRISTOL–MYERS SQUIBB COMPANY
THOMPSON ROAD FACILITY

OUTSIDE BULK STORAGE & PROCESS TANK INDEX

DS–61–1	500	Diesel
DS–61–2	275	Diesel
T–8	3,000	Spent butanol
DS–2B	1,000	Diesel
ST–7	15,000	KAC Buffer
ST–8	15,000	Butanol/ Acetone
ST–9	15,000	Butanol
ST–10	15,000	Butanol
ST–11	15,000	Acetone
ST–12	15,000	Butanol
T–7R	11,000	Methylene chloride
T–12R	11,000	Methanol
[redacted]		
DS–58	500	Diesel
DS–75	500	Diesel

TABLE 1.2
AERIAL PHOTOGRAPH REVIEW
BRISTOL–MYERS SQUIBB
THOMPSON ROAD SITE

DATE OF PHOTOGRAPH	SOURCE OF PHOTOGRAPH	TYPE OF PHOTOGRAPH	SCALE OF PHOTOGRAPH	PHOTOGRAPH NUMBER
July 5, 1938	U.S. Department of Agriculture Soil Conservation Survey Syracuse, New York	Vertical Overhead Aerial	1" = 1,667'	ARX–27–68
October 6, 1943	BMS Files	Low Angle Aerial	NA	499309–1
1946	BMS Files	Low Angle Aerial	NA	499309–2
1947	BMS Files	Low Angle Aerial	NA	499309–3
1948	BMS Files	Low Angle Aerial	NA	499309–4
1949	BMS Files	Low Angle Aerial	NA	499309–10
1949	BMS Files	Low Angle Aerial	NA	499309–11
October 15, 1951	U.S. Department of Agriculture Agricultural Stabilization and Conservation Service Aerial Photography Office Salt Lake City, Utah	Vertical Overhead Aerial	1" = 100'	ARX–3H–126X
1953	BMS Files	Low Angle Aerial	NA	499309–5
April 14, 1959	BMS Files Onondaga County Regional Planning Board Aerial Mosaic	Vertical Overhead Aerial	1" = 200'	Sheet No. 2071
1959	U.S. Department of Agriculture Agricultural Stabilization and Conservation Service Aerial Photography Office Salt Lake City, Utah	Vertical Overhead Aerial	1" = 100'	ARX–1V–44X
1960	BMS Files	Low Angle Aerial	NA	499309–6
1964	BMS Files	Vertical Overhead Aerial	1" = 200'	1426–16–537
1964	BMS Files	Low Angle Aerial	NA	499309–7
March 1966	BMS Files	Low Angle Aerial	NA	499309–8
June 22, 1966	U.S. Department of Agriculture Agricultural Stabilization and Conservation Service Aerial Photography Office Salt Lake City, Utah	Vertical Overhead Aerial	1" = 100'	ARX–1GG–107X
October 1966	BMS Files	Low Angle Aerial	NA	499309–9
April 20, 1967	BMS Files	Vertical Overhead Aerial	1" = 200'	1349–22–1052
April 29, 1972	BMS Files	Vertical Overhead Aerial	1" = 200'	11413–16–720
September 13,1978	U.S. Department of Agriculture Agricultural Stabilization and Conservation Service Aerial Photography Office Salt Lake City, Utah	Vertical Overhead Aerial	1" = 400'	36067–178–106X
April 10, 1981	BMS Files – Central Engineering Lockwood Mapping, Inc. Rochester, NY	Vertical Overhead Aerial	1" = 400'	758 PP No. 30
May 4, 1985	BMS Files	Vertical Overhead Aerial	1" = 400'	925–7 No. 124
August 19, 1988	BMS Files – Central Engineering Lockwood Mapping, Inc. Rochester, NY	Vertical Overhead Aerial	1" = 400'	1032 PP No. 143



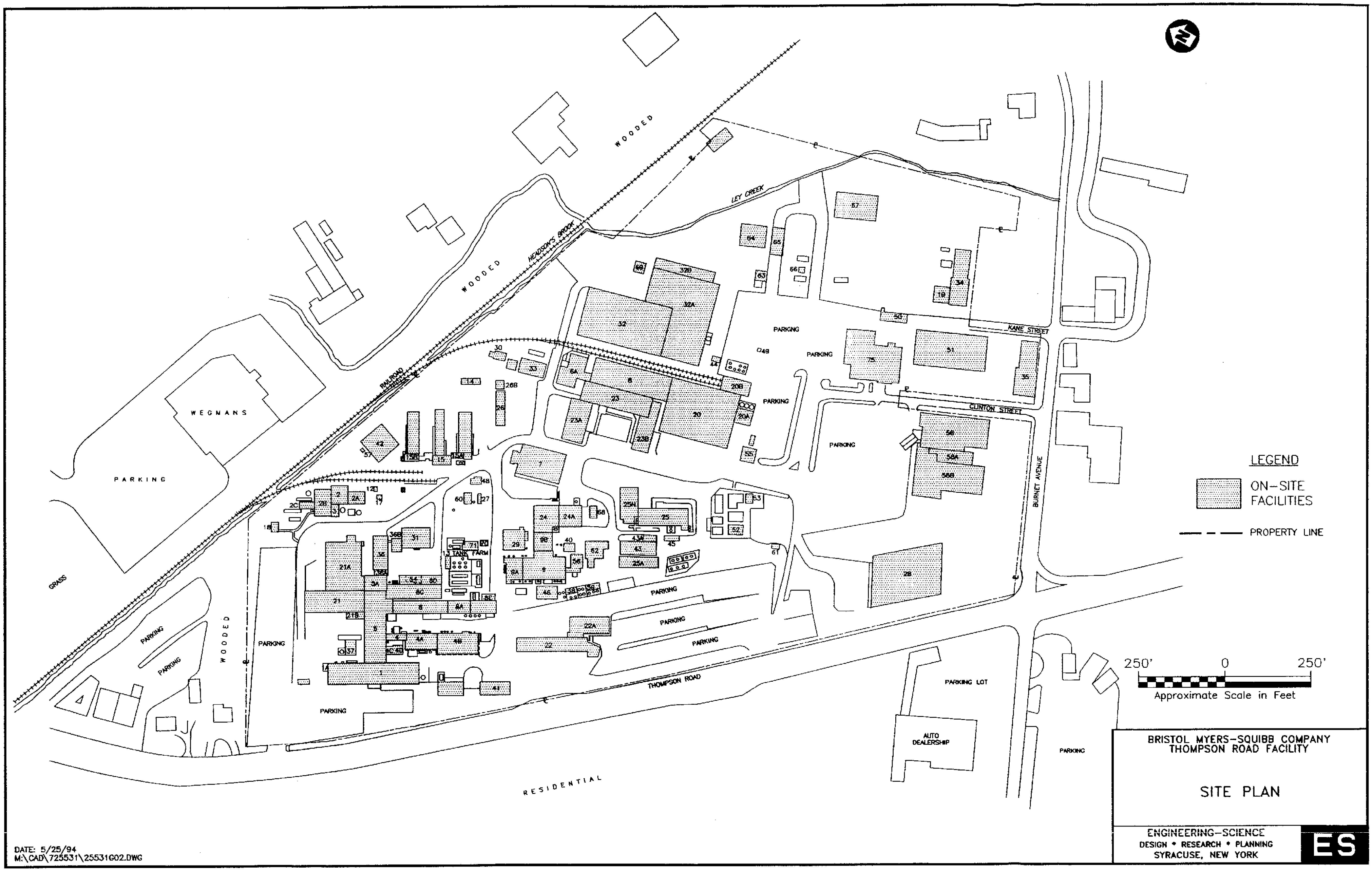
ENGINEERING-SCIENCE

SITE LOCATION MAP

BRISTOL-MYERS SQUIBB
Syracuse, New York

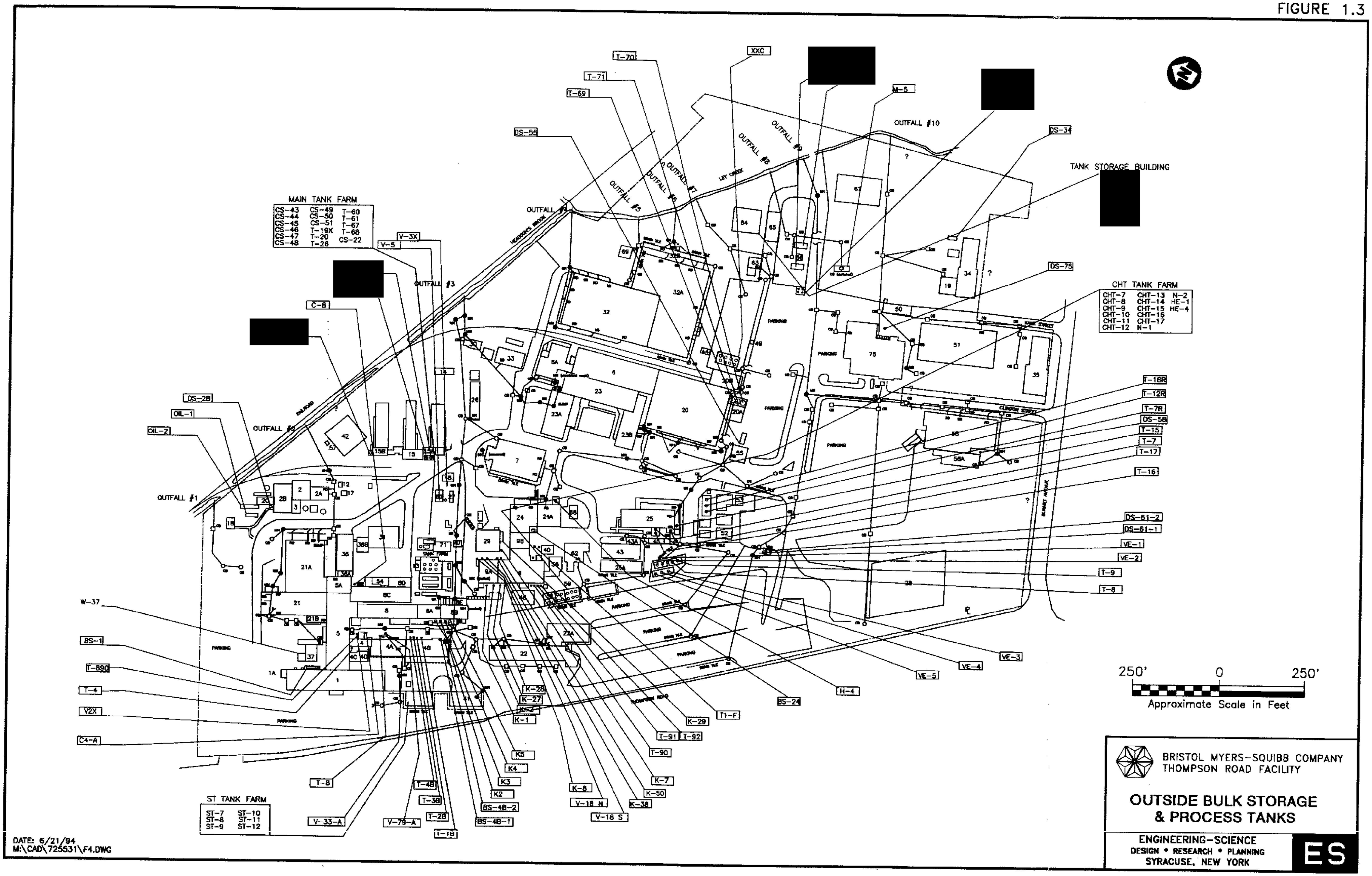
000850|D:\MASTERS\LOCATION.DRW

FIGURE 1.2



RACER0059517

FIGURE 1.3



MAIN TANK FARM
CS-43 CS-49 T-60
CS-44 CS-50 T-61
CS-45 CS-51 T-67
CS-46 T-18X T-68
CS-47 T-20 CS-22
CS-48 T-26
CHT TANK FARM
CHT-7 CHT-13 N-2
CHT-8 CHT-14 HE-1
CHT-9 CHT-15 HE-4
CHT-10 CHT-16
CHT-11 CHT-17
CHT-12 N-1
ST TANK FARM
ST-7 ST-10
ST-8 ST-11
ST-9 ST-12
TANK STORAGE BUILDING
OUTFALL #1
OUTFALL #2
OUTFALL #3
OUTFALL #4
OUTFALL #5
OUTFALL #6
OUTFALL #7
OUTFALL #8
OUTFALL #9
OUTFALL #10
LEY CREEK
THOMPSON ROAD
[redacted]
250' 0 250'
Approximate Scale in Feet
BRISTOL MYERS-SQUIBB COMPANY
THOMPSON ROAD FACILITY
OUTSIDE BULK STORAGE & PROCESS TANKS
ENGINEERING-SCIENCE
DESIGN • RESEARCH • PLANNING
SYRACUSE, NEW YORK
ES
DATE: 6/21/94
M:\CAD\725531\F4.DWG

SECTION 2

SITE CHARACTERIZATION

2.1 GEOLOGY AND HYDROGEOLOGY

2.1.1 Regional Setting

The Onondaga Limestone Escarpment divides Onondaga County in half into two physiographic provinces: the Erie-Ontario Plain to the north and the Allegheny Plateau to the south. The site is located within the Erie-Ontario Plain physiographic province near the Onondaga Limestone Escarpment and the border of the Allegheny Plateau physiographic province to the south (USDA, 1977). The area is typified by a lake-plain topography with low hills or ridges of till scattered throughout the plain. The elevation rises abruptly several hundred feet at the escarpment south of Syracuse.

The stratigraphy of this region is characterized by glacial and postglacial sediments overlying Silurian age bedrock. The glacial deposits in the vicinity of the site consist of till overlain by glacio-lacustrine silts and clays. During the Pleistocene, glaciers advanced and retreated across the county at least four times. The glaciers smoothed the hills and deepened the valleys. Clear evidence of at least two major glacial advances have been found in the Syracuse area. Thick deposits of till were formed beneath the ice sheets. As the ice sheets melted and retreated to the north, rivers and lakes were formed. Alternating layers of silts and clays were deposited in the deep glacial lakes. Meltwaters from the Onondaga trough drained eastwards toward the Butternut Valley. The site is located in the vicinity of this ancient meltwater channel (Dames & Moore, 1990).

Bedrock in the site vicinity consists of the Upper Silurian Salina Group. The Salina Group is comprised of three formations, the Syracuse Formation, the Camillus Formation, and the Bertie Formation (Rickard, 1970). The Syracuse Formation consists of interbedded shales, argillaceous dolomite, and evaporites and varies in thickness from 140 to 200 feet. The Camillus Formation consists primarily of olive-green dolomitic shale and ranges in thickness from 160 to 190 feet. The lower portion of the Bertie Formation consists of 27 to 30 feet of fine-grained, dark bluish dolostone. The dolostone is overlain by up to 40 feet of interbedded dark gypsum, shaley dolostone, and clay. The uppermost 7 to 10 feet consist of argillaceous dolostone. Bedrock has a regional dip to the south of approximately one degree.

Groundwater occurs in the glacial deposits and the bedrock. The silt and clay, and till deposits are characterized as poor aquifers. Average yields range from 0.1 to 0.5 gallons per minute in the silt and clay deposits to 0.1 to 2 gallons per minute in the till (Kantrowitz, 1970; USDA, 1977). Yields from the Salina Group bedrock range from 1 to 245 gallons per minute, with an average flow of 20 gallons per minute. Groundwater in the area is characteristically hard and contains excessive sulfate (USDA, 1977). Groundwater within the upper 100 feet of bedrock is also likely to be salty.

2.1.2 Surface Water Hydrology

The site is located in the Eastern Oswego River drainage basin which discharges into Lake Ontario. Surface waters from the site flow into the South Branch of Ley Creek. The South Branch of Ley Creek joins the North Branch of Ley Creek approximately 1.5 miles northwest of the site. Ley Creek then flows westward into Onondaga Lake. Several wetland areas are located adjacent to Ley Creek.

Ley Creek is classified as a Class D surface water body (6NYCRR). Class D surface water bodies are designated suitable for primary and secondary contact recreation. The southern part of Onondaga Lake is classified as a Class C surface water body. Class C surface water bodies are designated suitable for fishing and fish propagation.

2.1.3 Site Topography

The site is located on the eastern flank of the Eastwood hills. The ground surface slopes to the east from a maximum elevation of about 480 feet above sea level at the northwest end of the site to approximately 403 feet above sea level along the South Branch of Ley Creek. Natural slopes are steeper on the higher parts of the site (approximately 6 percent) and flatter in the lower areas adjacent to the creek. A topographic map of the site is presented in Appendix G.

2.1.4 Site Geology

Information about the subsurface geology at the site was obtained from previous monitoring well borings (Dames & Moore, 1990a, 1990b; O'Brien & Gere, 1994). Five stratigraphic units were encountered at the site: (1) fill, (2) marsh deposits, (3) glacio-lacustrine deposits, (4) glacial till, and (5) bedrock. A generalized stratigraphic column for the site is presented in Figure 2.1a. The subsurface stratigraphy of the site is illustrated on the east-west trending geologic cross-section in Figure 2.1b.

Bedrock was encountered in one boring, PW-5T, at a depth of 24 feet below the surface (Figure 2.1b). The top of bedrock may have been encountered in borings CH-2TD, CH-4TD and CH-5TD, however, no samples were obtained. Bedrock consists of the Upper Silurian Camillus Shale. The Camillus Shale consists of a weathered, olive-green shale with interbeds of gypsum.

The bedrock is overlain by the Vernon Till which has been interpreted to be a lodgement till. The till is composed of a very dense, red-brown silty clay and gravel with some fine to coarse sand. Pebbles in the till are subrounded and oriented at low angles to the bedding. The till varies in depth from about five feet below the ground surface in the western portion of the site to 29 feet below the ground surface in the eastern portion of the site. The till is approximately 25 to 30 feet thick in the vicinity of the CHT Tank Farm.

The till is generally overlain by glacio-lacustrine deposits. These deposits consist of brown to gray, medium to fine grained sands, silts, and clays. The sediments commonly exhibit thin laminations and fining upward cycles. The glacio-lacustrine unit is approximately 20 feet thick in the eastern portion of the site and thins to the west. It is absent or very thin in the westernmost well PW-5T.

In several borings, the glacio-lacustrine sediments were overlain by a thin, dark, organic-rich, silty clay which has been interpreted as a marsh deposit.

The uppermost unit at the site consists of fill. Fill was encountered in all of the monitoring well borings and varies in thickness from two to nine feet. The fill material consists primarily of brown gravel with varying amounts of sand, silt, and clay. Wood, asphalt, cinders, ash, brick, and concrete fragments were occasionally present in the fill material.

2.1.5 Site Hydrogeology

Groundwater elevations have been collected from the site monitoring wells during the various past investigations. Most recent groundwater elevations were collected on October 20, 1993 from the perimeter and notch wells (O'Brien & Gere, 1994) (see Figure 2.9).

The well logs and water levels indicate that two water bearing units are present at the site: (1) fill/glacio-lacustrine and (2) glacial till. The depth to groundwater at the site varies from approximately five feet below the ground surface near PW-6F to approximately 23 feet below the ground surface in well PW-5T. The Camillus Shale bedrock is not likely to be a significant water bearing zone in the vicinity of the site.

Slug tests were conducted by Dames & Moore in monitoring wells CH-1T and CH-5T located near the CHT Tank Farm. These wells are screened in the till unit. Slug tests indicate that the till has a low hydraulic conductivity ranging from 0.31 feet per day to 0.35 feet per day (Table 2.1). Based on these low hydraulic conductivity values, it appears unlikely that contaminants will migrate through the till into the underlying bedrock in areas where the till is deep and thick.

Figure 2.2 presents a groundwater elevation contour map for the fill and glacio-lacustrine units based on the October 20, 1993 data. The horizontal groundwater flow direction in the fill and glacio-lacustrine deposits is to the east towards Ley Creek. The gradient likely mimics the surface topography and is steeper in the western portion of the site. It appears that shallow groundwater discharges directly to Ley Creek. Recharge of the shallow aquifer on-site is likely to be limited because approximately 75 to 80 percent of the site is covered with buildings or is paved. The majority of the sewer lines are also located under paved areas. As a result, recharge on-site is not expected to significantly impact the distribution or movement of contaminants in the subsurface.

Figure 2.3 presents a groundwater elevation contour map for the deeper till unit based on the October 20, 1993 data. Flow directions in the till zone portray a similar pattern and direction when compared with the shallow unit. Based on water level elevations in wells near the creek, it appears that groundwater in the till unit may flow beneath Ley Creek.

Vertical hydraulic gradients were determined by comparing water level measurements in monitoring well pairs located across the site. Water level measurements suggest a downward flow potential exists between the shallow fill/glacio-lacustrine unit and the deeper till unit.

2.2 SITE HISTORY

This section describes the chronological history of the site's development since 1943. The history was developed based on information obtained from the aerial photograph review, Sanborn map review, file and report review, and discussions with plant personnel. Table 2.2 summarizes the building construction dates as well as present and past uses.

Period prior to 1943

The 1938 aerial photograph could only be viewed at the Onondaga County Soil Conservation Survey office. The 1938 aerial photograph indicates that the site was an open field. One building, owned by the National Cellulose Corporation, was located on the eastern portion of the site. This building is now called Building 6. Access to the building was via a dirt road from Thompson Road and by Clinton Street. Several houses were located along Clinton Street.

Period from 1943 to 1949

In 1943, Bristol-Myers purchased Cheplin Laboratories located on West Taylor Street in Syracuse. That same year, Cheplin Laboratories was licensed by the government to produce penicillin for the war effort. The Taylor Street facility did not offer the space needed for mass production of penicillin. In the summer of 1943, the government allocated $2 million for the construction of a new 41,000-square foot penicillin plant located on Thompson Road. Construction of the facility began in 1943. This building would later be renamed as Building 1. The plant was designed and operated by Cheplin Laboratories but was owned by the Defense Plant Corporation (the government agency that owned all such facilities).

In 1945, Bristol-Myers purchased the facility from the Reconstruction Finance Corporation (government property disposal agency). The facility consisted of a 35,000 square-foot laboratory building, boiler house, animal house and pump house as well as numerous fermentation, storage, and extraction tanks. The name was also changed officially to Bristol Laboratories.

Figure 2.4 presents a site map of the facility in 1949. The facility consisted of nine major buildings, a boiler house, cooling towers, tank farm, and a pump house. The facility was located on the northwestern portion of the site. The southern half of the site consisted primarily of open field and the eastern portion of the site was primarily wooded with residential houses located along Clinton Street.

Manufacturing and processing areas utilizing solvents were located in Buildings 1, 4 and 9. Building 1 was used for chemical production, pilot plants, and laboratories. Extraction was conducted in Buildings 4 and 9. Fermentation was conducted in Building 8. Solvents were stored in an above ground tank farm located just east of Building 8. This is now referred to as the Upper Main Tank Farm. Photographs and records indicate that this tank farm was constructed in 1946. The tanks were constructed on top of the ground and were surrounded by an earthen berm. Four underground tanks were also installed in the adjacent Lower Main Tank Farm. No. 6 fuel oil, used as a backup for the boilers, was stored in a 30,000 gallon partially below grade tank (Oil 2). According to records, this tank was installed in 1949.

Two areas of the site were used for storage of drums (drum storage areas 1 and 2). These areas were likely used for temporary storage of drums containing raw materials that were used in the production process. Drum storage area 2 was located directly south of Building 7. Drums were first visible in this area in the 1947 photograph. The drums were stacked in rows on the ground surface. Drum storage area 1 was located just east of Building 9. Drums were first visible in this area in the 1949 photograph. The drums were also stacked in rows on the ground surface. The storage areas were surrounded by earthen berms.

Two areas of the site were used as parking lots. One area was located north and west of Building 1 and the second area was located south of Building 20. A coal pile was located just east of the railroad spur near Building 2. The coal pile was visible in the 1946 photograph.

Land use surrounding the facility consisted of residential homes located along the west side of Thompson Road. Several houses were also located adjacent to the northwestern end of the facility. Land on the northeastern side of the Conrail Railroad tracks was partially wooded and swampy with houses located along Route 290. A large rectangular, one-story building, which appears to be a commercial business, was located across the tracks from Building 2. Numerous parked cars or trucks were visible in the parking lot adjacent to it. A second large rectangular, one-story building was located across the railroad tracks from the northeastern corner of the site. This appears to be some type of manufacturing building. At the southern end of the site, several two-story buildings were located along the southern side of Burnet Avenue. These appear to be commercial.

<u>Period from 1950 to 1959</u>

Figure 2.5 presents a site plan of the facility in 1959. Seventeen new buildings were added during the 1950's (Table 2.2). Expansion primarily occurred in the northwestern portion of the site adjacent to the existing buildings. Three buildings were located in the southern and eastern portion of the site. One building, Building 34, was acquired from a construction company and was used for vehicle and electric equipment storage. Building 28 was used for materials control, receiving and traffic control. Tractor trailer trucks parked adjacent to the building were visible in the 1959 aerial photograph. The third building, Building 35, was used for administration.

Manufacturing and processing areas utilizing solvents were located in the same areas but were expanded with the addition of adjacent Buildings 4A, 9A, 9B, and 29. Six additional underground storage tanks were installed in the Lower Main Tank Farm. Photographs indicate that the solvent recovery building (Building 27) in the Lower Main Tank Farm was constructed in 1953. Four additional underground storage tanks (No. 2, 3, 4, and 5) for storage of No. 6 fuel oil, were installed in 1951 adjacent to Building 18. An above ground oil tank (Oil 1) located between Building 2 and 18 is visible in the 1959 aerial photograph. This tank was reportedly used for storage of No. 2 fuel oil.

Drum storage areas 1 and 2 visible in the 1947 and 1949 photographs were still visible in the 1959 aerial photograph. A third drum storage area was located north of the railroad spur across from Building 6A (drum storage area 3). This area was also likely used for temporary storage of drums of raw materials. A second set of cooling towers was constructed in 1952 and appears in the 1953 aerial photograph. The coal pile is still visible between Buildings 2 and 15. The 1953 aerial photograph indicates that the stack adjacent to Building 6 (previously the National Cellulose Corporation) has been removed.

The two parking areas were expanded and a third large parking lot was added adjacent to Building 22. The houses were still present along Clinton Street. The 1956 Sanborn map indicates that the larger building on the south side of Clinton Street was used for shipping ice cream. The wooded area directly behind Building 6A has been cleared. A dirt road has also been cleared through the wooded area behind Building 20 and the parking area. This path joins Kane Street and leads to a triangular area between Ley Creek and the Conrail Railroad tracks. A dirt road from the scrap yard located to the east also leads to this area. Disturbed land and evidence of clearing are visible in this area.

Land use surrounding the facility was similar to that in the 1949 site plan. On the north side of the site, an elongate area has been cleared adjacent to the homes. This area appears to be a storage yard for lumber or pipes. The property along the eastern margin of the site on the eastern side of Ley Creek contains two structures. Scrap materials appear to be scattered across the property beginning in 1951. An area adjacent to the southern corner of the site, on the western side of the intersection of Burnet Avenue and Thompson Road, appears to be used as a tractor trailer parking area. Additional buildings have also been constructed along the south side of Burnet Avenue.

Period from 1960 to 1965

Figure 2.6 presents a site plan for the facility in 1965. Between 1960 and 1965, nine new buildings were added to the facility (Table 2.2). Expansion occurred primarily in the northwestern portion of the facility and consisted of additions to existing buildings. Building 19 was added in the southeastern portion of the site for storage of yards and grounds equipment.

Manufacturing and processing areas utilizing solvents were located in the same areas. Buildings 24 (chemical development and engineering) and 24A (chemical development pilot plant) were added adjacent to Building 9B.

As expansion and construction at the facility continued, the temporary drum storage areas were relocated further to the east. Drum storage areas 1 and 2 located near Buildings 7 and 9 have been cleared. The 1960 photograph shows that drums were removed from storage area 2 located south of Building 7, but were still visible for a short time after in storage area 1 near Building 9. In 1962 building 24A was constructed near the former location of drum storage area 1. Drum storage area 3 located north of the railroad spur across from Building 6A was still present. A new drum storage area (drum storage area 4) was added behind Building 6 in the previously wooded area. The 1964 aerial photograph indicates that the drums were stored in rows on the ground.

The coal pile was still located near Building 15 and the parking lots remain in the same locations. The lot near Building 20 has been expanded westwards into the previously existing open field. The 1964 photograph indicates that Building 7 was renovated. A stack has also been added to Building 6 and 6A (incinerator). The eastern portion of the site remains partly wooded and open field. Three houses have been removed from along Clinton Street. The other houses still remain.

Land use surrounding the facility remained the same. Debris is scattered in large piles across the scrap yard located adjacent to the eastern end of the site. The debris extended onto the eastern portion of the triangular lot between Ley Creek and Conrail Railroad tracks. A dirt road extended onto this area from the scrap yard. The large triangular lot located west of the intersection of Thompson Road and Burnet Avenue is still used for parking of tractor trailer trucks.

Period from 1966 to 1979

Figure 2.7 presents the site plan for the facility in 1979. Between 1966 and 1979, 31 new buildings were added to the facility (Table 2.2). Expansion occurred primarily in the northern half of the facility. Two buildings were added in the southern portion of the facility. Building 50 was constructed for truck sampling and Building 51 was used for administration.

Manufacturing and processing areas utilizing solvents remained largely in the same areas. Building 4B was added to extraction, Building 43 was added for dry storage, extraction and splitting, and Buildings 25 was added as an organic synthesis pilot plant.

The ST Tank Farm, located south of Building 1, was constructed in 1968 for storage of acetone, butanol, caustics, and MIBK. This tank farm was located in the area of the former entrance road near Building 1. The CHT tank farm located east of Buildings 9 and 25A was installed in 1969. These tanks are located in a former open area adjacent to the parking area. The VE tank farm, located just south of Building 25A, was installed in 1979. This tank farm was located in an area that was previously an open field near the parking area. In approximately 1972, eight used stainless-steel fermenter tanks were stored in the open area north of Building 32. This area was previously used as a drum storage area from approximately 1953 to 1966.

Drum storage area 4 located behind Building 6 was used until 1966 when Building 32 was constructed in this area. Drum storage area 3 located between Headson's Brook and the railroad spur was also used until 1966. Beginning in 1966, a new drum storage area for raw materials was located east of Building 32A (drum storage area 5). The wooded area located behind and to the east of Building 20 was cleared in 1966 as well as the remainder of the eastern portion of the site. In the 1967 aerial photograph, a portion of the eastern edge of the site adjacent to Ley Creek has been scraped and the material has been used to fill in the area to the northwest of this area.

The parking lot located near Building 20 was expanded to the east into the previously wooded area and where the houses along Clinton Street were located. The remaining three houses located along the eastern side of Clinton Street were removed by 1972. Building 51 was constructed in this area in 1979. The ice cream shipping building on the west side of Clinton Street was removed by 1979. The parking lot near Building 1 was expanded in 1972 to include the area in front of Building 1.

The coal pile was removed in 1966 and the third set of cooling towers and pump house were constructed in this area. In 1969 maintenance Building 42 was also constructed in the area of the former coal pile.

Evidence of clearing and grading are visible on the triangular area located between the Conrail Railroad tracks and Ley Creek in the 1972 aerial photograph. A dirt road leads from the parking area to a small bridge across Ley Creek.

Surrounding land use has changed slightly. Piles of debris were still scattered across the property located adjacent to the east end of the site. A new rectangular building was constructed on this site with a new parking area prior to 1979. The channel of Ley Creek was re-routed to the east to parallel the property line. Prior to 1972, a large building surrounded by a parking area (automotive dealership) was constructed on the rectangular property located west of the intersection of Thompson Road and Burnet Avenue. This area was previously used as a parking area for large trucks. A shopping center (grocery store) and parking area were also constructed at this intersection on the south side of Burnet Avenue. This was previously an open field.

Additional buildings and parking areas have been added to the property located adjacent to the northwest corner of the facility. A new shopping center (grocery store) and large parking area were constructed across the Conrail Railroad tracks from the northern corner of the site. The shopping center is located in the area where the large equipment warehouse and distributor was previously located. The channel of Ley Creek in this area was re-routed to the south. Another elongate building was constructed adjacent to the shopping center with parking along the northwestern and southern sides.

Period from 1980 to 1994

Figure 2.8 presents the site plan for the facility in 1994. Between 1980 and 1994, 24 new buildings were added to the facility (Table 2.2). Expansion occurred primarily in the central and southeastern portions of the site.

Manufacturing and processing areas utilizing solvents remained in the same areas. Buildings 62 and 25N were constructed in the area of the previous drum storage areas. Buildings 58, 58A, and 58B were constructed in an area that was previously open field. The distillation recovery system, Buildings 52, and 53 were installed in 1980. These are located in the area that was previously a parking lot.

Drum storage area 5, located east of Building 32A, was used until 1988 when it was replaced by the new tank farm ([redacted]) which was constructed in this area. [redacted] a new drum storage building, was constructed in 1989. This building is located in an area that was previously open and was used as a parking area for truck trailers.

The triangular piece of land between the Conrail Railroad tracks and Ley Creek was graded and cleared in the 1981, 1985 and 1988 aerial photographs. The property is accessed by a dirt road leading from the parking area to a small bridge over Ley Creek. Property usage surrounding the site is similar to that on the 1979 site plan.

Major Solvent Usage Areas

Figures 2.4 through 2.8 illustrate major solvent usage and storage areas at the facility since 1943. With the exception of the drum storage areas, major solvent usage and storage areas are located primarily in the northwest portion of the facility and have remained consistent over time. The southern portion of the site consisted of open fields parking areas until approximately 1980. Buildings currently occupying this area consist of administrative, receiving and traffic control, and research facilities. The parking areas have also remained in the same locations throughout time. The eastern portion of the site remained undeveloped and wooded until 1966. This area is currently occupied by research laboratories and the new tank farm installed in 1988.

2.3 SPILLS AND LEAKS

Available BMS records, dating to 1984, indicate that spill or leak events have occurred at the BMS site. The majority of the documented spills and leaks discharged directly to the sanitary sewer system. A total of eleven significant spill or leak events were identified in the spill files. Significant spill events were defined as those involving releases of greater than 1,000 gallons of hazardous substances or those that directly impacted adjacent soils. All of the major spills and leaks were reported to the appropriate authorities. A summary of major spill/leak events is presented in Table 2.3

7/25/76 - Building 18 Tanks #6 Fuel Oil Spill

The 1977 Spill Prevention Control and Countermeasure (SPCC) plan indicated that on July 25, 1976, 2,276 gallons of #6 fuel oil were spilled into Headson's Brook. The spill occurred while transferring fuel oil from Receiving Tank 3 to Supply Tank 4 located near Building 18.

During clean-up and oil removal operations, plastic and straw oil booms were placed along Ley Creek at Exeter Street, Court Street, Route 298, and Town Line Road. The oil collected behind these booms was pumped into tank trailers by Northeast Oil Co. for subsequent recovery. The banks of the brook were manually and mechanically cut back to remove oil trapped in the vegetation. The final boom at Town Line Road was removed on August 26, 1976.

11/7/84 - Tank CHT-5 Methanol Spill

On November 7, 1984, approximately 4,900 gallons of methanol overflowed from tank CHT-5 located in the CHT Tank Farm. The spill drained to the sanitary sewer system.

8/12/85 - Distillation Column MIBK Spill

On August 12, 1985, approximately 1,500 gallons of MIBK leaked from the distillation column to the sanitary sewer. Solvent odors were detected at the Ley Creek Pump Station and the Metro Plant. A sample analyzed from the wastewater pH control building ([redacted]) indicated the following concentrations:

Acetone	420 ppm
Methanol	2,230 ppm
Methylene Chloride	990 ppm
MIBK	1,360 ppm
Butanol	50 ppm

10/86 - Security Center Leaking Diesel Tank

In October 1986 water was observed in a 300-gallon underground diesel tank (DS-55) located adjacent to the Security Center (Building 55). Stained soils and minor leakage were detected after one end of the tank was excavated. As a result, the tank was excavated and removed along with all stained soils and properly disposed. Inspection of the tank revealed some holes at the bottom of one side and near the outside weld.

1/7/86 - Solvent Recovery MIBK Spill

On January 7, 1986, approximately 1,100 gallons of MIBK overflowed from tank R-3 to the sanitary sewer. Tank R-3 is located near Building 52 (solvent recovery). Samples collected from [redacted] (wastewater pH control building) indicated the following concentrations:

MIBK	640 ppm
Acetone	120 ppm
Butanol	90 ppm
Methylene Chloride/IPA	10 ppm

MIBK was detected in samples collected from the Ley Creek Pump Station and the Metro Plant at concentrations of 260 ppm and 110 ppm, respectively.

6/6/88 - CHT-1 Methanol/Methylene Chloride Spill

Between June 3, 1988 and June 6, 1988, approximately 3,600 gallons of methanol and 1,500 gallons of methylene chloride leaked from tank CHT-1 to the sanitary sewer. Tank CHT-1 is located in the CHT Tank Farm Vault which has a drain to the sanitary sewer. Upon discovery, the remaining contents of the tank were transferred to a spare tank and a plug was placed in the adjacent sanitary manhole to isolate it from the sanitary system. A flow of approximately three gallons per minute was observed to be flowing into the sanitary manhole. A pump was installed in the manhole to pump the contents to solvent recovery. Tank CHT-1 was then flushed to expedite the recovery of the solvents.

10/18/88 - Tank Oil 2 No. 6 Fuel Oil Spill

During an upgrade of Tank Oil 2 in October 1988, soils impacted by No. 6 fuel oil were encountered under and around the tank. Approximately 300 cubic yards of visibly impacted soils were removed and properly disposed (BMS Internal Memorandum, 1988). Two soil samples were collected and analyzed for petroleum hydrocarbons and solvents. Sample results indicated total hydrocarbon concentrations of 4,900 mg/kg (ppm) and 4,400 mg/kg.

6/30/91 - Building 59 Pipe Rack Methylene Chloride/Methanol/DCHA Spill

On June 30, 1991, approximately 1,000 gallons of a mixture containing methylene chloride (25%), methanol (50%), and water (25%) with small amounts of dicyclohexylamine and dimethylaniline, were spilled from a broken transfer pipe. The spill flowed down the gravel slope located at the south end of Building 59, onto the asphalt, into the storm sewer, and then to Ley Creek. Efforts were made to clean up the spill by spreading adsorbent material to the wetted area.

An inspection of Ley Creek did not show any evidence of the materials in the creek. Approximately 40 yards of soil from the affected area were removed. After excavation, a composite sample was collected from the affected area and analyzed by TCLP for methanol and methylene chloride. Results indicated concentrations of methanol at 23 mg/l and methylene chloride at 0.16 mg/l.

7/19/91 - 4B Sump Butanol/MIBK/Acetone Leak

On July 19, 1991 during cleaning and inspection, a hole approximately 18-inches in diameter was discovered in the concrete floor of an in-ground sump designated "4-B". The sump is located adjacent to the eastern side of Building 4. Liquid in the sump would have likely contained approximately 1,000 to 5,000 ppm total solvents consisting of a mixture of acetone, MIBK, and butanol.

A new three-inch concrete floor was poured in the base of the sump. In accordance with a plan submitted to the NYSDEC, a soil boring was conducted on April 10, 1992 just east of the sump. The soil boring was conducted to a depth of approximately three feet below the base of the sump. A composite soil sample was collected from four feet above the base of the sump to three feet below the base of the sump and analyzed by the toxicity characteristic leaching procedure (TCLP) for MIBK, acetone, butanol, and total hydrocarbons. The results indicated non-detects for all the parameters measured (Appendix F).

8/16-21/91 - HEPA Filter Housing Titus System Methanol Spill

Between August 16, 1991 and August 21, 1991, approximately 5,000 gallons of methanol were discharged to the air from the HEPA filter housing located in the Titus system. Two possible sources were identified. Cracks were discovered in the HEPA filter housing in which an air stream containing methanol passes. These were repaired upon discovery. Loss of liquid in a seal leg or trap which normally drained condensates from the vapor stream was also discovered. The liquid seal leg was refilled upon discovery.

7/2/92 - Building 52 Solvent Recovery MIBK Spill

On July 2, 1992, approximately 2,500 gallons of MIBK were accidentally discharged from tank RT-3 to the sanitary sewer. Tank RT-3 is used to feed MIBK to solvent recovery column C6. The discharge resulted from a valve that was accidentally left open. Procedures were put in place to prevent a reoccurrence.

2.4 SUMMARY OF PREVIOUS INVESTIGATIONS

Various investigations have been conducted at the site between 1989 and 1994. The investigations were conducted in response to leaks, as parts of closure plans or upgrades for chemical storage tanks, and as required by the May 14, 1992 Consent Order which relates to a number of BMS's storm sewer Outfalls.

2.4.1 CHT Tank Farm Closure

The CHT tank farm is located southeast of Building 9 adjacent to the parking lot. Six tanks, CHT-1 through CHT-6, were located in a concrete vault. The vault was filled with gravel for fire protection and drained to the sanitary sewer system. The tanks were used to store 7-ACA mother liquors (methanol and methylene chloride), methyl isobutyl ketone (MIBK), and methanol. The tanks were taken out of service as a result of the June 6, 1988 leak of methanol and methylene chloride to the sanitary sewer system.

In October 1990, Dames and Moore performed a site assessment for closure of the CHT vault (Dames and Moore, 1990). Two monitoring well clusters (CH-1T, CH-1M, CH-2T, CH-2M) were installed during the initial phase of the investigation and three additional well clusters (CH-2TD, CH-3F, CH-3TS, CH-4TS, CH-4TD, CH-5TS, and CH-5TD) were installed during the second phase of the investigation (Figure 2.9).

Three soil samples were collected from well CH-2T and analyzed for methanol, methylene chloride, and MIBK. Methylene chloride was detected in the samples at concentrations of 1.1 mg/kg, 3.9 mg/kg, and 108 mg/kg, respectively (Table 2.4). MIBK was detected at concentrations of 0.01 mg/kg and 0.042 mg/kg. Methanol was not detected in the soil samples.

Two rounds of groundwater samples were collected and analyzed for methanol, methylene chloride, and MIBK. Methylene chloride was detected in the groundwater samples from well CH-2T at concentrations of 13,200 mg/l and 13,400 mg/l (Table 2.5). Methanol was detected at concentrations of 1.5 mg/l and 2.8 mg/l. MIBK was not detected in the groundwater samples. Slug tests were performed on four monitoring wells to determine aquifer parameters. A report was submitted to the NYSDEC upon completion.

2.4.1.1 Groundwater Remediation System

In September 1991, Dames & Moore installed a dual phase vacuum extraction pilot plant to remove the methylene chloride detected in soil and groundwater (Dames & Moore, 1992). Six additional monitoring wells (CH-6T, CH-7T, CH-8T, CH-9T, CH-10T and CH-11T) were installed as part of the pilot plant to define the extent of the plume and to provide air inlet and extraction wells. Groundwater samples indicate the plume is limited in extent to approximately a 50 feet square area. The location of extraction wells, CH-2T, CH-2TD and CH-10T, other monitoring wells, and the extent of the methylene chloride plume are shown on Figure 2.10.

The system operates by using submersible well pumps to dewater the impacted area while simultaneously applying a vacuum to the extraction well heads to draw methylene chloride out of the ground in the vapor phase. A schematic of the vapor extraction system (VES) is presented in Figure 2.11. The three extraction wells are located approximately eight feet apart due to the small size of the plume.

The vapor extraction system has proven capable of removing methylene chloride from the impacted area. Since start-up, approximately 1,100 pounds of methylene chloride have been removed from the impacted area (Figures 2.12 and 2.13). Groundwater recovery rates during this period have remained essentially constant (Figure 2.14). In addition, groundwater sampling indicates that the methylene chloride concentrations in the most contaminated extraction well, CH-2T, have decreased by an order of magnitude from an initial level of 13,200 mg/l to 1,900 mg/l in November 1993 (Table 2.6). The increase in concentration from November 1992 to November 1993 was due to the extraction system being shut down for mechanical repair prior to the November 1993 sampling. Methylene chloride concentrations in the downgradient wells, CH-9T, CH-5TS and CH-5TD, have remained at or below the detection limit, indicating that the plume is being contained.

Groundwater levels measured in September 1994 also demonstrate containment of the plume (Figure 2.15). Water level elevations indicate that the flow directions have been reversed and that groundwater within the plume area is being captured by the extraction wells.

BMS is currently evaluating an intermittent operating strategy for the system. This strategy may be more effective than continuous operation of the system due to the low permeability of the glacial till. During intermittent shut down of the system, the dewatered section of the till recharges and contaminant levels increase slightly. This larger mass of contaminants can then be removed when the system is started up again.

2.4.2 Upper Main Tank Farm Upgrade

The Upper Main Tank Farm is located between Buildings 8 and 9. The tank farm was installed in 1946 and consists of above ground tanks. The tanks are used to store lard oil, butanol, MIBK, methanol, acid, and caustics that are used throughout the process areas. In 1991, the tank farm was extensively upgraded to include 16 new tanks and concrete secondary containment dikes.

Prior to the tank farm upgrade, O'Brien & Gere conducted a soil gas survey within the tank farm area (O'Brien & Gere, 1990). Soil gas samples were collected at 53 locations throughout the tank farm and analyzed in the field for total organic vapor concentrations. Soil gas sampling results are summarized in Table 2.7 and Figure 2.16.

Stabilized soil gas readings ranged from non detect to 18.0 ppm. Low readings between 1.0 ppm and 5.0 ppm were detected around tanks T-1, T-2, T-3, T-5, T-11, T-19, and T-68. The highest reading of 18.0 ppm was detected adjacent to the pump house (Building 13). A peak reading of 1,249 ppm was recorded at point SG-19 just before drawing water into the instrument. This reading is questionable and may not be representative due to moisture in the probe. To determine the validity of this reading, additional soil gas samples were collected within five feet of each side of point SG-19. Significantly lower readings (2.2 ppm to 18 ppm) were measured in the surrounding points further suggesting that the elevated reading at SG-19 may be questionable. Soil samples were not collected for chemical analysis.

The top one to two feet of soil was removed from the tank farm area in order to install foundation footings and pads. Soil removed during construction was periodically monitored by BMS personnel with an HNU meter for the evolution of organic vapors. All measurements were below the action level of 5 ppm above background with most of the readings being less than 1 ppm (Juszkiewicz, 1991). No solvent odors were detected in any of the excavated areas.

2.4.3 Lower Main Tank Farm Closure

The Lower Main Tank Farm is located adjacent to the Upper Main Tank Farm. Four underground tanks were installed in 1949. Six additional underground tanks installed in 1952 and three underground tanks were installed in 1966. The tanks were used for storage of butanol, methanol, and acetone. One tank, T-47, was used as a 90-day hazardous waste storage tank for waste solvents consisting of MIBK, acetone, butanol, methanol, isopropanol, methylene chloride, water, and relatively small quantities of other solvents.

The tank farm was closed in December 1989 in accordance with a NYSDEC approved closure plan (Dames & Moore, 1990). Due to the presence of numerous underground utilities, building foundations, and fragile transite pipes, the tanks were closed in-place. Closure activities included removal of the remaining liquids and sludge, washing and rinsing, and internal inspection of each tank. No holes, cracks or dents were observed in any of the tanks during the inspection. The tanks and connecting pipes were then filled with a concrete slurry.

As part of the closure plan, three monitoring well clusters (LMTF-1M and 1T, LMTF-2M and 2T, and LMTF-3M and 3T) were installed along the downgradient, northeast side of the tank farm (Figure 2.9). Groundwater samples were collected from the wells in December 1989 and January 1990. Samples in the first round were analyzed for methanol, isopropanol, n-butanol, sec-butanol, tert-butanol, acetone, methylene chloride and MIBK. The wells were resampled in January 1990 for n-butanol, sec-butanol, and tert-butanol.

Tert-butanol was detected at concentrations above the Class GA groundwater standard in wells LMTF-1M and 1T, LMTF-2T, and LMTF-3T in the first sampling round (Table 2.8). The highest concentrations (600 μg/l) were detected in well LMTF-2T. MIBK was detected at low concentrations (up to 25 μg/l) below the groundwater quality standard in wells LMTF-2M and 2T, LMTF-3M and 3T. Methanol, methylene chloride and acetone were not detected in the groundwater samples.

Three additional sampling rounds were conducted in April 1990, August 1990, and November 1990. Samples were analyzed only for tert-butanol. The results indicate that tert-butanol was consistently detected in wells LMTF-1T, LMTF-2T, and LMTF-3T at similar concentrations. After completion of one year of sampling data, sampling was discontinued in December 1990 in accordance with the closure plan.

2.4.3.1 T-47 Sump Closure

The T-47 sump was located in the yard area of the Lower Main Tank Farm. It consisted of a concrete manhole approximately 2.1 feet in diameter and 12.5 feet deep. The original purpose of the manhole is unknown, however, standing water was often observed in the manhole. BMS drawings indicate that the sump had no inlets, but did have one outlet, a four-inch perforated flex pipe, which was connected to the sanitary sewer cleanout located just south of Building 60.

Closure activities on the T-47 Sump were performed on August 19, 1994 (BMS Internal Memo, 8/25/94). Soils from around the sump and the clean-out were excavated to determine if the sump was connected to the clean-out by a flex pipe as shown in the original drawings. Excavation indicated that the sump was not connected to the clean-out and that the flex pipe had been previously cut approximately four feet from the sump. The flex pipe was removed and the excavation was backfilled. Standing water in the sump was pumped into 55-gallon drums which were labeled and stored in Building 67 for analysis and proper disposal. The water had no odor or sheen. The sump was then completely filled in with concrete. Analytical results from the water are pending and will be submitted as part of the T-47 closure report.

2.4.4 Yard Underground Tank Closures

Six underground storage tanks were closed in December 1989 in accordance with NYSDEC approved tank closure protocols (O'Brien & Gere, 1990). Tanks T04 and T05, located between Buildings 9B and 40, were closed in-place. These tanks were used to store heptane. Tanks T8A and T9A, located adjacent to Building 4C, were also closed in-place. These tanks were used to store acetone. Tanks M6 and M7, located adjacent to Building 50, were removed. These tanks contained used oil and waste solvents.

As part of the closure activities, all tanks were cleaned, washed, and Petro-Tite[R] tested. All tests indicated loss rates of less than 0.05 gallons per hour and were therefore not considered to be leaking by NFPA Standard 329. Tanks T04, T04, T8A, and T9A were then filled with a concrete slurry. Tanks M6 and M7 were excavated and removed. During excavation, an HNU photoionization detector was used to monitor for organic vapors. No visibly contaminated soil or vapors were encountered. Three soil samples were collected from the bottom of the M6 tank excavation and analyzed for methylene chloride, chloroform, acetone, and MIBK. Sample results were non-detect for the measured parameters.

2.4.5 Perimeter Well Monitoring

Perimeter monitoring wells were installed in August and September 1989 as part of the Lower Main Tank Farm and CHT Tank Farm closure plans (Dames & Moore, 1990). The wells were installed to evaluate groundwater quality along the site perimeter. The perimeter wells consisted of one upgradient monitoring well (PW-1T), and three downgradient well clusters (PW-2M and 2T; PW-3MS, 3-MD, and 3T; and PW-4F, 4LS, 4LD, and 4T) (Figure 2.9). The wells were screened in the fill, lacustrine deposits, and the till. Groundwater samples were collected from the perimeter wells on October 5, 1989. Samples were analyzed for methanol, isopropanol, butanol, acetone, methylene chloride, MIBK, and heptane. Sample results were non-detect for the measured parameters (Table 2.9).

Additional perimeter wells were installed and sampling was conducted during the Storm Sewer Contaminant Source Investigation. Results are summarized in the following section.

2.4.6 Storm Sewer Contaminant Source Investigation

Results of the Storm Sewer Contaminant Source Investigation are summarized in this section. A more detailed discussion is presented in Appendix E.

Inspection activities associated with the preparation of a storm water permit application were conducted in 1991 by O'Brien & Gere. The inspection identified areas of integrity loss throughout the storm sewer system and dry weather flows at four outfalls (Outfalls 002, 003, 007, and 009). It was suspected that in areas where the storm sewer and sanitary sewer were in close proximity, chemical constituents may be exfiltrating from the sanitary sewer into the storm sewer.

Additional field activities and system modifications to the storm sewer, designed to minimize infiltration, were conducted in 1991. Dry weather flow sampling of the four outfalls was conducted in December 1991. These data were used to prepare a State Pollution Discharge Elimination System (SPDES) permit application. Sampling indicated the presence of volatile organic compounds, metals, alcohols and other chemical constituents in the dry weather flow discharge from the outfalls. As part of the SPDES permit requirements, approximately 6,600 linear feet of storm sewer piping were relined, and 120 manholes were rehabilitated.

On May 14, 1992 BMS and the NYSDEC entered into a Consent Order which identified tasks to identify and eliminate the source of chemical constituents detected in the storm sewer. In 1993, O'Brien & Gere conducted an investigation to identify potential sources of chemical constituents in the storm sewer and determine the extent of groundwater contamination, if any, resulting from the sanitary sewer system (O'Brien & Gere, 1994). Activities conducted to determine potential sources included: data review, water and dye testing, inspection of over 100 manholes, and television inspection of approximately 14,500 linear feet of sanitary sewer system piping along trunklines 1-5, 7, and 8.

Results of the television inspection indicated that approximately 8,100 feet of pipe exhibited varying degrees of deterioration. Approximately 1,500 feet of pipe exhibited minimal deterioration (slightly offset joints, small cracks or stress fractures). Approximately 5,600 feet of pipe exhibited moderate deterioration (separated, joints, cracks, root intrusion) and 1,000 feet of pipe exhibited extensive deterioration (missing inverts, severely cracked/broken pipes, collapsed or missing pipe). Deteriorated sections of pipe along Trunklines 5 and 7, which convey large quantities of process wastewater, are believed to be the source of constituents impacting the storm sewer.

Activities conducted to determine the extent of any groundwater contamination included installation of ten new monitoring wells and three rounds of groundwater sampling (Figure 2.9). Monitoring well PW-5T was installed to replace upgradient well PW-1T which was dry. A downgradient well cluster (PW-6F, 6L, and 6T) was installed near storm sewer Outfall 007, and two "notch well" clusters were installed along storm sewer Outfalls 003 (MW-35-1, 2, and 3) and 007 (MW-77-1, 2, and 3). A round of groundwater samples were collected from the perimeter wells in August 1992 prior to installation of the new wells. Two additional rounds were collected in August and October 1993 from the perimeter and "notch" wells. The samples were analyzed for volatile organic compounds, alcohols, wet chemistry (pH, COD, phenol, sulfate, ammonia, phosphorus), and molybdenum.

Three volatile organic compounds (VOCs) were detected at concentrations above the water quality standards in two downgradient perimeter monitoring wells (Table 2.9). 1,2-Dichlorobenzene was detected in the August 1992 (28 μg/l) and August 1993 (19 μg/l) sampling rounds from well PW-2T. It was not detected in the October 1993 sampling round. 1,2-Dichloroethane (6 μg/l) and 1,1,1-trichloroethane (11 μg/l) were detected in the August 1993 sampling round from well PW-6L but not the October 1993 sampling round. Three other VOCs were detected at low concentrations near the detection limit in August 1993 in well PW-6L. 1,1-Dichloroethane was detected at levels near the detection limit in wells PW-2T, PW-3MD, and PW-3MS. No VOCs were detected in PW-5T, the upgradient perimeter well.

Methanol was detected at a concentration of 990 μg/l in the October 1993 sample from well PW-4LS. Since methanol had not been detected in the previous sampling rounds, the well was resampled in December 1993. The results indicated non-detectable levels of methanol. Methylene chloride, MIBK, acetone, and butanol, major chemicals used and stored at the site, were not detected in any of the downgradient monitoring wells.

Sulfate concentrations exceeded the groundwater standard in all of the till wells, including the upgradient well. It was below the groundwater standard in the shallow wells. This indicates that background levels of sulfate are characteristically high in the area.

Chlorobenzene was detected at concentrations above the groundwater standard in notch well MW-35-1 in the August and October 1993 sampling rounds. In the October 1993 sampling round, MIBK (16 μg/l) and acetone (190 μg/l) were detected in notch wells MW77-1 and MW77-2, respectively (Table 2.10).

2.5 SUMMARY OF GROUNDWATER QUALITY

2.5.1 Summary of Groundwater Quality

A total of 42 monitoring wells have been installed at the site between 1989 and 1994 (Figure 2.9). Over the course of the various investigations, groundwater samples have been collected from the site monitoring wells. Eleven individual volatile organic compounds (VOCs) have been detected in the groundwater beneath the site (Figure 2.17). The following paragraphs summarize the results of these investigations.

Methylene chloride was only detected in monitoring wells located downgradient of the CHT Tank Farm area. Wells in this area defined a very localized plume with concentrations up to 13,400 mg/l. Methylene chloride was not detected in any of the other on-site wells or the perimeter wells. The methylene chloride plume is currently being remediated with a dual phase vapor extraction system. Since start-up, approximately 1,100 pounds of methylene chloride have been removed from the impacted area. Methylene chloride concentrations in the most contaminated extraction well, CH-2T, have decreased by an order of magnitude from an initial level of 13,200 mg/l to 1,900 mg/l in the November 1993 sampling round.

Acetone, a commonly used chemical on-site, was detected in only one sample from notch well MW77-2 at a concentration of 190 μg/l. This well is located adjacent to a deteriorated section of the sanitary sewer along Trunkline 7. Acetone was not detected in the two adjacent wells or in any of the other on-site wells or the perimeter wells. Additional groundwater samples are needed from this area to determine the validity of this result.

Methanol, a commonly used chemical on-site, was detected at a concentration of 990 μg/l in one sample from perimeter well PW-4LS. Methanol was not detected in the previous or subsequent sample. It was also not detected in any of the other on-site monitoring wells.

Chlorobenzene and 1,2-dichlorobenzene were each detected in one well. Chlorobenzene was detected in two samples from well MW35-1 at concentrations of 9 μ/l and 10 μg/l . This well is located near a deteriorated section of the sanitary sewer along Trunkline 5. Samples were not obtained from the adjacent two wells because they were dry. Chlorobenzene has not been detected in any other on-site wells. 1,2-Dichlorobenzene was detected in perimeter well PW-2T at concentrations of 19 μg/l and 28 μg/l. It was not detected in the adjacent shallow well or in any of the other wells on-site.

1,1,1-TCA and 1,2-DCE were detected in one sample from perimeter well PW-6L at concentrations of 11 μg/l and 6 μg/l, respectively. These compounds were not detected in the subsequent sampling round or in the adjacent wells or other on-site wells. 1,1,1-TCA and 1,2-DCE were also not detected in wastewater samples from the various areas at the site. Additional groundwater samples are needed from this area to determine the validity of these results.

Tert-butanol was consistently detected in three till monitoring wells (LMTF-1T, LMTF-2T and LMTF-3T) located downgradient from the Lower Main Tank Farm. Concentrations ranged from 130 μ/l to 600 μg/l. Tert-butanol was not detected in the adjacent shallow well pairs. It was also not detected in wells located downgradient from these or in any other on-site wells indicating a very limited extent of contamination.

The remaining compounds were detected at or near the detection limits (1,1-DCA and tetrachloroethylene) or at low concentrations (MIBK) in one or two wells.

The existing groundwater data demonstrates the presence of low levels of a few volatile organic compounds in a limited number of groundwater wells sampled on the site. While Class GA groundwater quality standards or guidance values were slightly exceeded at a limited number of sample locations, available data do not indicate extensive contamination of groundwater beneath the site. In particular, the most commonly used chemicals at the site (acetone, MIBK, methanol and butanol), with the exception of methylene chloride near the CHT Tank Farm, were not detected in the groundwater downgradient of major use areas. While groundwater contamination is present near the CHT Tank Farm, it is limited to a small defined area which is currently undergoing remediation.

Based on the groundwater flow directions, history of the surrounding properties, and existing groundwater analytical data, it is unlikely that significant contaminants have migrated on-site from adjacent properties. The residential area located west of and upgradient of the site, existed prior to beginning construction of the facility in 1941. The scrap yard adjacent to the eastern corner of the site is located downgradient of and on the other side of Ley Creek. Potential contaminants from the scrap yard may enter Ley Creek which flows across the eastern corner of the site, but would likely not affect on-site soils or groundwater. Commercial areas located south of the site along Burnet Avenue are unlikely to impact the site because groundwater flows to the south.

2.5.2 Adequacy of Existing Information

2.5.2.1 Assessment of Monitoring Well Conditions

In July 1992, O'Brien & Gere Engineers conducted an assessment of the perimeter monitoring wells to evaluate their general condition and integrity. Based on the assessment, the cracked concrete pad on well PW-2T was replaced and well PW-2M was replaced. The assessment also recommended that a concrete pad be installed at wells PW-4T, 4LS, 4LD and 4F. The other wells were found to have no apparent problems.

The wells were also inspected during the site inspection conducted in March 1994. Concrete pads have not been installed at wells PW-4T, 4LS, 4LD and 4F to date. The concrete pad at well LMTF-3M was cracked and should be replaced. No apparent problems with the condition or integrity of the other wells was noted. Well pairs LMTF-1, LMTF-2 and LMTF-3 should be redeveloped as necessary prior to sampling.

2.5.2.2 Assessment of Monitoring Well Locations

Site monitoring wells are screened in the shallow fill and lacustrine units as well as the deeper till deposits. The existing site wells were installed in order to further investigate four specific areas of the site:

- Perimeter of the site (PW-1 to PW-6 well clusters)
- Downgradient areas of extensively deteriorated sewer lines (MW33-1 and MW77-1 well clusters)
- CHT Tank Farm (CH-1 to CH-11 wells)
- Lower Main Tank Farm (LMTF-1 to LMTF-3 well clusters)

However, based on location, these wells can also be used to evaluate groundwater conditions across the entire site.

Four monitoring well clusters are located along the downgradient perimeter of the facility. The wells monitor the fill and lacustrine deposits as well as the deeper till. These wells are situated downgradient from the oldest portion of the facility (based on the historical development of the site), manufacturing and process areas with high solvent use, and major solvent storage and transfer areas. Based on the above information and the groundwater flow direction, these wells are adequately spaced and properly located to evaluate groundwater quality at the site perimeter.

However, groundwater may also be migrating off-site via preferential pathways which intercept the shallow groundwater flow. Major preferential pathways at the site have been identified and consist of the sanitary and storm sewer bedding material. Well clusters PW-3 and PW-6 are located adjacent to the downgradient portions of sanitary Trunklines 5 and 7 which convey large quantities of process wastewater. These lines also run parallel to storm sewer Outfalls 003 and 007 which may provide preferential pathways for contaminant migration. Notch well nests MW-35-1,2 and 3 and MW-77-1, 2 and 3 are located within the bedding material of the storm and sanitary sewers along Outfalls 003 and 007 where integrity losses have been identified. These wells are located along the downgradient portions of the sewers and should provided an indication of whether the bedding material is acting as a major pathway. Additional geoprobe sampling is planned along numerous deteriorated sections of sanitary sewer Trunklines 1, 5 and 7 as part of the Storm Sewer Contaminant Source Investigation (see Section 4).

Outfalls 002 and 009 sewer bedding may provide a preferential pathway for contaminant migration from processing areas, sanitary sewers, and former drum storage locations. Therefore, geoprobe samples will be collected from the bedding material at the downgradient end of Outfalls 002 and 009 (see Section 4, Figure 4.1).

Three monitoring well clusters (LMTF-1, 2, and 3) are located directly downgradient of the Lower Main Tank Farm. In addition, these wells are also located downgradient from the Upper Main Tank Farm, the oldest part of the facility, the ST Tank Farm, and the extraction and solvent recovery areas. These wells should provide a good indication of the groundwater quality downgradient from the older processing and solvent use areas.

The CHT Tank Farm wells are located directly downgradient of the CHT vault. These wells define the limited extent of the methylene chloride plume.

2.5.2.3 Assessment of Existing Analytical Data

During the course of the previous investigations, on-site monitoring wells have been sampled for the major solvents used at the facility. Samples were reportedly collected in accordance with proper sampling procedures. Although the data were not validated, most of the data are consistent and are valid and usable. However, two types of inconsistencies were identified. These include: compounds that were only detected in one sample but were not detected in previous or subsequent samples, and compounds that were detected in one well but were not detected in adjacent wells or any other on-site wells. Specific examples of these are as follows:

- Methanol was detected in one groundwater sample from perimeter well PW-4LS during October 1993. Methanol was not detected in the previous three samples. Methanol was also not detected in a subsequent sample collected in December 1993.

- Acetone was detected in only one sample from notch well MW77-2 at a concentration of 190 μg/l. Acetone was not detected in the two adjacent wells or in any of the other on-site wells or the perimeter wells.
- Low concentrations of 1,1,1-TCA and 1,2-DCE were detected in one groundwater sample from perimeter well PW-6L during August 1993. No VOCs were detected in the October 1993 groundwater sample.
- Chlorobenzene and 1,2-dichlorobenzene were each detected in one well at low concentrations. They were not detected in the adjacent wells or any other on-site wells.

In areas such as the Upper and Lower Main Tank Farm, the CHT Tank Farm and former drum storage area 1, adequate data have been collected to reach a conclusion on the presence or absence of contamination at levels of environmental concern. Those areas where adequate information is not available were identified as study areas. Additional data will be collected from these areas during the SIRS or Storm Sewer Contaminant Source Investigation.

2.6 IDENTIFICATION AND EVALUATION OF POTENTIAL SOURCE AREAS

This section identifies and discusses those areas of the site for which the facility operations may have had the potential to impact the soil or groundwater. These potential source areas were identified based on past and present land uses, length of time used, storage or use of hazardous substances, reported major spills, and potential routes to soil and groundwater. Information from each area was evaluated to determine if sufficient information exists to make a valid engineering judgment as to the presence of contamination at a level of environmental concern. Levels of environmental concern were determined by the application of best engineering judgment, using as a guidance the Department's Technical and Administrative Guidance Memorandum entitled "Determination of Soil Cleanup Objectives and Cleanup Levels" dated January 24, 1994. If sufficient data were not available, the need for additional information was evaluated.

Potential source areas at the site can be grouped into four categories: (1) manufacturing and processing areas, (2) chemical storage areas (tanks and drums), (3) petroleum storage area, and (4) coal storage area. These are discussed in the following section and shown on Figure 2.18.

2.6.1 Manufacturing and Processing Areas

2.6.1.1 Deteriorated Sanitary Sewers

Deteriorated sections of the sanitary sewers were identified as potential source areas during the Storm Sewer Contaminant Source Investigation. Results of a television inspection indicated that approximately 8,100 feet of pipe in the sanitary sewer system exhibited varying degrees of deterioration (see Figure 4.1). Severely deteriorated sections of pipe along Trunklines 5 and 7, which convey large quantities of process wastewater, are believed to be the source of constituents impacting the storm sewer. This source is being investigated as part of the Storm Sewer Contaminant Source Investigation. Groundwater samples will be collected with the Geoprobe along deteriorated sections of the sanitary sewer (see Figure 4.1). The samples will be analyzed for the following parameters which include the most commonly used chemicals at the site:

pH
Chemical Oxygen Demand (COD)
Phenolics, total
Sulfate (as SO_4)
Nitrogen, Ammonia (as N)
Phosphorus, total
Molybdenum, total
Butanol
Dicyclohexylamine (DCHA)
Dimethylaniline (DMA)
Isobutanol *
Isopropanol
Methanol
Acetone
Methylene Chloride
MIBK
Toluene

* Isobutanol will be used as an indicator for isobutylchloroformate (IBCF). Isobutanol is a breakdown component of IBCF which is unstable in water.

The Storm Sewer Contaminant Source Investigation is summarized in more detail in Appendix E. This investigation and list of parameters should be adequate to determine if chemicals from the deteriorated sewer lines are impacting surrounding groundwater. If contamination is detected, additional Geoprobe points will be installed to determine the extent of the impacted area.

2.6.1.2 Buildings 1 and 4 Area

The Building 1 and 4 area was identified as a potential source area due to the age, use of chemicals (manufacturing and process areas), and presence of deteriorated sewers nearby. Buildings 1 and 4 are one of the oldest parts of the facility. Building 1 is currently under renovation for penicillin extraction. In the past, Building 1 has been used for chemical production, pilot plants, laboratories, and maintenance. Building 4 is currently and in the past was used for penicillin-V and cephalosporin extraction. Principal chemicals used in Buildings 1 and 4 include acetone, ammonia, butanol, methanol, methylene chloride, MIBK, and acetonitrile.

Ammonia (147 - 265 mg/l), acetone (63 - 65 mg/l), n-butanol (12.7 - 150 mg/l), isopropanol (29.7 - 163.9 mg/l), methanol (7.7 - 12 mg/l), MIBK (235 - 320 mg/l), and methylene chloride (0.009 - 0.085 mg/l) were detected in wastewater samples collected in 1992 from the Building 4 area (ES, 1992). Television inspections of the sanitary sewer system conducted in 1993 indicated areas of moderate deterioration (separated, joints, cracks, root intrusion, offset joints) and extensive deterioration (missing inverts, severely cracked/broken pipes, collapsed or missing pipes) near Buildings 1 and 4 (O'Brien & Gere, 1994). These areas may provide a pathway for chemical constituents in the wastewater to migrate into the surrounding soils and groundwater.

Various above ground and underground storage tanks are also located adjacent to Building 4, 4A, and 4B. Two underground storage tanks, T-8A and T-9A located between Buildings 4 and 4C, were closed in place in 1989 (O'Brien & Gere, 1990). These tanks were previously used for storage of acetone. As part of the closure, the tanks were cleaned, washed, and Petro-Tite tested. Both tests indicated loss rates of less than 0.05 gallons per hour and were therefore not considered to be leaking by NFPA Standard 329. The tanks were then filled with a concrete slurry.

On July 19, 1991 during cleaning and inspection, a hole was discovered in the concrete floor of an in-ground sump designated "4-B". The sump is located adjacent to the eastern side of Building 4 and contained a mixture of acetone, MIBK, butanol, and water. A new three-inch concrete floor was poured in the base of the sump. In accordance with a plan submitted to the NYSDEC, a soil boring was conducted on April 10, 1992 just east of the sump. The soil boring was conducted to a depth of approximately three feet below the base of the sump. A composite soil sample was collected from four feet above the base of the sump to three feet below the base of the sump and analyzed by the toxicity characteristic leaching procedure (TCLP) for MIBK, acetone, butanol, and total hydrocarbons. Sample results are presented in Appendix F and indicated non-detects for all the parameters measured.

As part of the Storm Sewer Contaminant Source Investigation, groundwater samples will be collected with the Geoprobe system along deteriorated sections of the sanitary sewer in the Buildings 1 and 4 area (see Figure 4.1). Six samples will be collected along the sewer lines near Building 4. One of these samples will be collected near the "4-B" sump. These sampling locations will also be located near the adjacent storage tanks. As a result, the proposed samples will be adequate to determine the presence of contaminants in the groundwater in the Building 1 and 4 area due to leakage from the sewer lines or from the storage tanks. No additional sampling is needed as part of the Site Contamination Study at this time. Results from the groundwater samples will be used to assess the potential presence of a source area and the need, if any, for additional groundwater and soil sampling.

2.6.1.3 Buildings 9 and 24 Area

The Building 9 and 24 area was identified as a potential source area due to the age, use of chemicals (manufacturing and process areas), past spills, and the presence of deteriorated sewers nearby. Building 9 is also one of the oldest facilities at the site. Buildings 9 and 9A are used for extraction, splitting and solvent recovery. Buildings 24 and 24A were constructed in 1962. Building 24 is used for chemical development and engineering, and Building 24A is used for chemical development pilot plants. Principal chemicals used in Building 9 include methanol, methylene chloride, MIBK, and acetonitrile. Various other chemicals are used in the pilot plant.

Ammonia (2.76 - 642 mg/l), acetone (1.4 - 1.5 mg/l), isopropanol (2.6 mg/l), methanol (12 - 31 mg/l), MIBK (28 - 30.6 mg/l), acetonitrile (11 - 160.1 mg/l), and methylene chloride (0.004 - 7.9 mg/l) were detected in wastewater samples collected in 1992 from the Building 9 and 24 areas (ES, 1992). Television inspections of the sanitary sewer system conducted in 1993 indicated areas of moderate and extensive deterioration near Buildings 9 and 24 (O'Brien & Gere, 1994). These areas may provide a pathway for chemical constituents in the wastewater to migrate into the surrounding soils and groundwater.

Several above ground and underground storage tanks are also located adjacent to Buildings 9 and 9A. In 1989, two underground storage tanks, T-04 and T-05, located between Buildings 9B and 40 were closed in place (O'Brien & Gere, 1990). These tanks were previously used for storage of heptane. Closure of the tanks consisted of cleaning, washing, and Petro-Tite testing. Both tests indicated loss rates of less than 0.05 gallons per hour and were therefore not considered to be leaking by NFPA Standard 329. The tanks were then filled with a concrete slurry.

As part of the Storm Sewer Contaminant Source Investigation, groundwater samples will be collected from four locations along the deteriorated sections of the sewer near Buildings 9 and 24 (see Figure 4.1). In addition to being located near the sanitary sewer, samples will also be located downgradient from the storage tanks near the building. As a result, the proposed samples will be adequate to determine the presence of contaminants in the groundwater due to leakage from the sewer lines or from the storage tanks. No additional sampling is needed as part of the Site Contamination Study at this time. Results from the groundwater samples will be used to assess the potential presence of a source area and the need, if any, for additional groundwater and soil sampling.

2.6.2 Chemical Storage Areas

2.6.2.1 ST Tank Farm

The ST Tank Farm was identified as a potential source area due to the age, use (storage and transfer of hazardous chemicals), presence of a tanker unloading area, and deteriorated sewers nearby. The ST Tank Farm is located south of Building 1. Six tanks, ST-7 through ST-11, were installed in 1968 in a concrete vault. The vault is enclosed on all four sides and the bottom, and drains to the sanitary sewer. The tanks were covered with gravel for fire protection. Prior to installation of the vault, this area was occupied by an entrance road to the plant.

Tanks in the vault are currently used to store acetone, butanol and caustic, however, MIBK was also stored in the tanks in the past. Any leakage from the tanks or piping in the vault would drain to the Building 4B sewer column for solvent recovery. A television inspection of the sanitary sewer indicated an area of extensive deterioration just north of the tank farm (O'Brien & Gere, 1994). In addition, a tanker truck unloading area which is no longer used was located adjacent to the vault.

As part of the Storm Sewer Contaminant Source Investigation, two groundwater samples will be collected along the deteriorated section of the sewer system (Figure 4.1). The proposed samples are located downgradient from the ST Tank Farm and the tanker unloading area. These groundwater samples will be adequate to determine the presence of contaminants in the groundwater due to leakage from the sewer lines or from the tanker unloading area. No additional sampling is needed as part of the Site Contamination Study at this time. Results from the groundwater samples will be used to assess the potential presence of a source area and the need, if any, for additional groundwater and soil sampling.

2.6.2.2 Upper Main Tank Farm

The Upper Main Tank Farm was identified as a potential source area due to the age, use (storage and transfer of hazardous chemicals), and lack of previous adequate containment. The tank farm is one of the older chemical storage areas at the site. The above ground tanks were installed in 1946 and were used for the storage of lard oil, butanol, MIBK, methanol, acid, and caustics. The tanks were located on top of a gravel covered area and therefore any leaks could impact underlying soils and groundwater. A tanker unloading area was also located adjacent to the southern side of the tank farm.

The tank farm was extensively upgraded in 1991 to include 16 new tanks and concrete secondary containment dikes. The soil gas survey conducted prior to the upgrade indicated only low soil gas readings. The one peak reading of 1,249 ppm is questionable and may not be representative due to moisture in the probe and significantly lower readings (2.2 ppm to 18 ppm) on each side.

Approximately one to two feet of soil was removed from the tank farm area in order to install foundation footings and pads. Soil removed during construction was also periodically monitored by BMS personnel with an HNU meter for the evolution of organic vapors. All measurements were below the action level of 5 ppm above background with most of the readings being less than 1 ppm (Juszkiewicz, 1991). No solvent odors were detected in any of the excavated areas.

Three monitoring well pairs (LMTF-1M and 1T, LMTF-2M and 2T, and LMTF-3M and 3T) are located immediately downgradient of the Lower Main Tank Farm and approximately 200 feet downgradient of the Upper Main Tank Farm. Tert-butanol was consistently detected in wells LMTF-1T, LMTF-2T, and LMTF-3T at concentrations up to 600 μg/l in the five sampling rounds. MIBK was detected at low concentrations (up to 25 μg/l) below the groundwater quality standard in wells LMTF-2M and 2T, LMTF-3M and 3T. Methanol, methylene chloride and acetone were not detected in the groundwater samples. Tert-butanol was not detected in the further downgradient wells MW-35-1, 2 and 3.

The source of the tert-butanol in the groundwater samples is unknown. N-butanol is stored in the tanks, however, tert-butanol is not known to have been stored in the tanks. Tert-butanol is soluble in water and has a low toxicity level (LD50 orally in rats = 3.5 g/kg). Since tert-butanol is not stored in the tank farm, only very low levels of MIBK were detected in the groundwater, and very low levels of VOCs were detected in the soil gas survey, contaminants at levels of environmental concern do not appear to be present in the vicinity of the tank farm.

Additional groundwater data, however, will be collected in the vicinity of the tank farm as part of the Storm Sewer Contaminant Source Investigation. Two geoprobe samples will be collected along deteriorated sewers along the southern side of the tank farm (see Figure 4.1).

2.6.2.3 Lower Main Tank Farm

The Lower Main Tank Farm was identified as a potential source area due to the age, use (storage and transfer of hazardous chemicals), and lack of containment (underground tanks not enclosed in a vault). The tank farm is located adjacent to the Upper Main Tank Farm and consists of 13 underground storage tanks which were installed in 1949, 1952, and 1966. The tanks were used for storage of butanol, methanol, and acetone. One tank, T-47, was used as a 90-day hazardous waste storage tank for waste solvents consisting of MIBK, acetone, butanol, methanol, isopropanol, methylene chloride, and relatively small quantities of other solvents.

The tanks were closed in-place in December 1989 (Dames & Moore, 1990). Closure activities included removal of the remaining liquids and sludge, washing and rinsing, and internal inspection of each tank. No holes, cracks or dents were observed in any of the tanks during the inspection. Since no holes or cracks were observed in the tanks, the tanks were not pressure tested. The tanks and connecting pipes were then filled with a concrete slurry.

Three monitoring well pairs (LMTF-1M and 1T, LMTF-2M and 2T, and LMTF-3M and 3T) are located adjacent to the downgradient side of the tank farm. Tert-butanol was consistently detected in wells LMTF-1T, LMTF-2T, and LMTF-3T at concentrations up to 600 μg/l in the five sampling rounds. MIBK was detected at low concentrations (up to 25 μg/l) below the groundwater quality standard in wells LMTF-2M and 2T, LMTF-3M and 3T. Methanol, methylene chloride, isopropanol, and acetone were not detected in the groundwater samples. None of these compounds were detected in the further downgradient wells MW-35-1, 2 and 3 or perimeter well cluster PW-3. The extent of the tert-butanol therefore appears to be limited to a small area near the tank farm.

The source of the tert-butanol in the groundwater samples is unknown. N-butanol is stored in the tanks, however, tert-butanol is not known to have been stored in the tanks. Tert-butanol is soluble in water and has a low toxicity level (LD50 orally in rats = 3.5 g/kg). Since only tert-butanol was detected in the downgradient groundwater and no holes or cracks were found in the tanks, contaminants at levels of environmental concern do not appear to be present in the vicinity of the tank farm.

Additional groundwater data, however, will be collected downgradient of the tank farm. One geoprobe sample will be collected approximately 50 feet downgradient of monitoring wells LMTF-1, 2 and 3 (see Figure 4.1). The sample will be analyzed for tert-butanol as well as the other parameters specified in the Storm Sewer Contaminant Source Investigation,

2.6.2.4 CHT Tank Farm

The CHT Tank Farm was identified as a potential source area due to the age, use (storage and transfer of hazardous chemicals), records of past spills, and presence of a tanker unloading area. The CHT Tank farm consists of 14 above ground tanks and six underground tanks within a concrete vault. The vault drains to the sanitary sewer. The tanks were used to store 7-ACA mother liquors (methanol and methylene chloride), methyl isobutyl ketone (MIBK), methanol and DMA.

Two major spills (greater than 1,000 gallons) were reported from the CHT Tank Farm. On November 7, 1984 approximately 4,900 gallons of methanol were spilled from tank CHT-5 to the sanitary sewer. On June 6, 1988, a leak was detected from tank CHT-1. Approximately 3,600 gallons of methanol and 1,500 gallons of methylene chloride were discharged to the sanitary sewer from the vault drain. A tanker unloading area was also located just northeast of the tank farm.

The six tanks within the vault were removed in 1990. A site assessment was performed in 1990 for closure of the CHT vault. Two monitoring well clusters were installed during the initial phase of the investigation and three additional well clusters were installed during the second phase. Methylene chloride was detected in soil samples from well CH-2T at concentrations of 1.1 mg/kg, 3.9 mg/kg, and 108 mg/kg, respectively (Table 2.4). MIBK was detected at concentrations of 0.01 mg/kg and 0.042 mg/kg. Methanol was not detected in the soil samples.

Methylene chloride was detected in the groundwater samples from well CH-2T at concentrations up to 13,400 mg/l. Methanol was detected at concentrations up to 2.8 mg/l. These concentrations exceeded the groundwater standards. MIBK was not detected in the groundwater samples.

In September 1991, Dames & Moore installed a dual phase vacuum extraction pilot plant to remove the methylene chloride detected in soil and groundwater. Groundwater samples indicate the plume is limited in extent. Details of the system design are discussed in Section 2.4.1. The vapor extraction system has proven capable of removing methylene chloride from the impacted area. Since start-up, approximately 1,100 pounds of methylene chloride have been removed from the impacted area. In addition, groundwater sampling indicates that the methylene chloride concentrations in the most contaminated extraction well, CH-2T, have decreased by an order of magnitude from an initial level of 13,200 mg/l to 1,900 mg/l in November 1993. Methylene chloride concentrations in the downgradient wells have remained at or below the detection limit, indicating that the plume is being contained.

Although contaminants are present at levels of environmental concern in this area, the plume is being actively remediated and contained. Other than the current monitoring program, no additional sampling of this area is needed.

2.6.2.5 Former Drum Storage Area 1

Former drum storage area 1 was identified as a potential source area due to the past use (temporary storage of chemicals used in the production process), lack of adequate containment, and storage directly on the ground surface. The drum storage area was located just east of Building 9 and consisted of a 100-feet by 100-feet square area. This area was used to store drums of chemicals, prior to their use in the production process, from approximately 1949 to 1960. Chemicals likely being stored included methylene chloride, MIBK, acetone, methanol, isopropanol, toluene, and possibly small amounts of other chemicals used by the pilot plants. Photographs indicate that the drums were stored vertically in rows on the ground surface. No containment was visible around the area in the photographs.

Two monitoring wells, CH-5TS and CH-5TD, installed during the CHT closure investigation are located in within the former drum storage area (Figure 2.13). Methylene Chloride, methanol, and MIBK were not detected in the groundwater samples from these wells. Reportedly, no evidence of contamination was encountered during construction of Building 62 which is located within the former storage area. Based on these results, contaminants do not appear to be present at levels of environmental concern in the former drum storage area 1. No additional sampling is needed.

2.6.2.6 Former Drum Storage Area 2

Former drum storage area 2 was identified as a potential source area due to the past use (temporary storage of chemicals used in the production process), lack of adequate containment, and storage directly on the ground surface. The drum storage area was located just south of Building 7 and consisted of a rectangular area approximately 100 feet wide and 200 feet long. This area was used to store drums of chemicals, prior to their use in the production process, from approximately 1947 to 1960. Chemicals likely being used included methylene chloride, MIBK, acetone, methanol, isopropanol, toluene, and possibly small amounts of other chemicals used by the pilot plants.

Photographs indicate that the drums were stored in rows on the ground surface. The drums were stored vertically and lying down on their sides. A fence was located around two sides of the storage area; however, no other containment was visible in the photographs. No groundwater samples have been collected within this area or directly downgradient. As a result, additional information is needed to determine if contaminants may be present in soil and groundwater at levels of environmental concern.

As part of the Storm Sewer Contaminant Source Investigation, groundwater samples will be collected from five locations along the deteriorated sections of the sewer downgradient of the former drum storage area (see Figure 4.1). In addition, two groundwater samples will be collected from within the former drum storage area as part of the Site Investigation and Remediation Study (SIRS) (see Figure 4.1). Results from the groundwater samples will be used to assess the potential presence of a source area and the need, if any, for additional groundwater and soil sampling.

2.6.2.7 Former Drum Storage Area 3

Former drum storage area 3 was identified as a potential source area due to the past use (temporary storage of chemicals used in the production process), lack of adequate containment, and storage directly on the ground surface. The drum storage area was located north of Building 6A in a triangular area between the main Conrail Railroad tracks and the railroad spur. This area was used to store drums of chemicals, prior to their use in the production process, from approximately 1953 to 1966. Chemicals likely being stored included methylene chloride, MIBK, acetone, methanol, isopropanol, toluene, and possibly small amounts other chemicals used by the pilot plants.

Photographs indicate that the drums were stored in rows on the ground surface. No containment was visible around the area in the photographs. No groundwater or soil samples have been collected within this area or directly downgradient from it. As a result, additional information is needed to determine if contaminants may be present in soil and groundwater at levels of environmental concern.

Two groundwater samples will be collected from within the former drum storage area as part of the SIRS (see Figure 4.1). Results from the groundwater samples will be used to assess the potential presence of a source area and the need, if any, for additional groundwater and soil sampling.

2.6.2.8 Former Drum Storage Area 4

Former drum storage area 4 was identified as a potential source area due to the past use (temporary storage of chemicals used in the production process), lack of adequate containment, and storage directly on the ground surface. The drum storage area was located directly west of Building 6 and consisted of a 150 feet by 150 feet square area. This area was used to store drums of chemicals, prior to their use in the production process, from approximately 1960 to 1966. Prior to 1960, this area was wooded. In 1966, Building 32 was constructed in this area.

Chemicals likely being stored in the drums may have included methylene chloride, MIBK, acetone, methanol, isopropanol, toluene, and possibly small amounts of other chemicals used by the pilot plants. Photographs indicate that the drums were stored in rows on the ground surface. No containment was visible around the area in the photographs.

A monitoring well cluster (PW-4F, 4T, 4LD, and 4LS), installed during the perimeter monitoring program, is located approximately 50 feet downgradient of the storage area. Only methanol was detected in one sample at a concentration of 990 μg/l. It was not detected during the resampling. No groundwater or soil samples have been collected within the drum storage area. As a result, additional information is needed to determine if contaminants may be present in soil and groundwater at levels of environmental concern.

Two groundwater samples will be collected from within the former drum storage area as part of the SIRS (see Figure 4.1). Results from the groundwater samples will be used to assess the potential presence of a source area and the need, if any, for additional groundwater and soil sampling.

2.6.2.9 Former Drum Storage Area 5

Former drum storage area 5 was identified as a potential source area due to the past use (temporary storage of chemicals used in the production process), lack of adequate containment, and storage directly on the ground surface. The drum storage area was located east of Building 32A and consisted of a large rectangular area. A second smaller square area was located just north of Building 34. These areas were used to store drums of chemicals, prior to their use in the production process, from approximately 1966 to 1988. Prior to 1966, this area was wooded. In 1988, Buildings 63, 64 and 65 were constructed in this area.

Chemicals likely being stored in the drums may have included methylene chloride, MIBK, acetone, methanol, isopropanol, toluene, and possibly small amounts of other chemicals. Photographs indicate that the drums were stored in rows on the ground surface. No containment was visible around the area in the photographs.

A monitoring well cluster (PW-6F, 6T, and 6L), installed during the Storm Sewer Contaminant Source Investigation, is located downgradient of the storage area. Several compounds (1,1,1-TCA, 1,2-DCE, 1,1-DCA, TCE, and chlorobenzene) were detected at low concentrations in one groundwater sample from well PW-6L. These compounds were not detected in the subsequent sampling round.

During excavation for extension of Building 32A in 1988, broken glass bottles, fiber drums, debris, and gold colored soil were encountered in a small area. Debris and affected soil from the areas was excavated and properly disposed. Two soil samples were collected in 1988 for laboratory analysis, one from the area of broken glass bottles, and a composite from the excavated soils. The samples were analyzed for VOCs, SVOCs, pesticides/PCBs, metals, cyanide, and phenol. Laboratory results are included in Appendix F. In addition to metals, only toluene was detected at an estimated concentration of 1 μg/l in the composite sample. Two PAHs, fluoranthene and anthracene were detected at the detection limit. Similar debris was encountered in another small area northeast of Building 32A during excavation for sewer lines in 1991.

During excavation for a pipe trench located east of building 32B on April 8, 1994, a layer of white powder encapsulated in a layer of plastic was encountered at a depth of three feet. Approximately 40 cubic yards of material were removed. No solvent odors or HNU readings were detected. A sample was collected and analyzed for methanol, ethanol, n-butanol, isopropyl alcohol, and TCLP waste characteristics. Laboratory results are included in Appendix F. Results indicated that all compounds were either not detected or were below regulatory levels.

Based on the results from the downgradient groundwater samples and presence of fill materials, additional information is needed to determine if contaminants may be present in groundwater beneath this area at levels of environmental concern.

Three groundwater samples will be collected from within the former drum storage area 5 as part of the SIRS (see Figure 4.1). Two of the samples will also be located within or as near as possible to the sewer bedding of Outfalls 007 and 008. In addition, one sample will be collected downgradient of the drum storage area adjacent to Outfall 009 as part of the Storm Sewer Contaminant Source Investigation (see Figure 4.1). Results from the groundwater samples will be used to assess the potential presence of a source area and the need, if any, for additional groundwater and soil sampling.

2.6.3 Petroleum Storage Areas

2.6.3.1 Building 18 Fuel Oil USTs

A total of six oil storage tanks were located near the boiler house. Four underground storage tanks (No. 2, 3, 4, and 5) were located adjacent to Building 18 and contained No. 6 fuel oil. These tanks were installed in 1951 and were abandoned over the years due to leaks (Appropriation Request Memo, 1986). On July 25, 1976 approximately 2,276 gallons of #6 fuel oil were spilled into Headson's Brook while transferring fuel oil from tank 3 to tank 4. Cleanup operations were initiated the same day. The BMS appropriation request indicates that the tanks were to be desludged, cleaned, inspected and removed along with surrounding soils in 1986. No further documentation of the removal project was found during the file search.

Two additional oil storage tanks were located near Building 2C. Tank Oil 1 is an above ground tank used to store No. 2 fuel oil. Tank Oil 2 was installed in 1945 and was used to store No. 6 fuel oil. The tank was located approximately 15 percent below grade and was set in a containment dike. The containment dike consisted of an eight-inch concrete block wall with a gravel-over-sand floor.

During an upgrade of Tank Oil 2 in 1988, soils impacted by fuel oil were encountered under and around the tank. Approximately 300 cubic yards of visibly impacted soils were removed and properly disposed (BMS Internal Memorandum, 1988). Two soil samples were collected and analyzed for petroleum hydrocarbons and solvents. Laboratory results are included in Appendix F. Sample results indicated total hydrocarbon concentrations of 4,900 mg/kg (ppm) and 4,400 mg/kg. The tank was replaced with a new above ground tank with a secondary containment dike.

No groundwater samples have been collected within this area. As a result, additional information is needed to determine if contaminants may be present in groundwater at levels of environmental concern.

Four groundwater samples will be collected adjacent to the former underground tank locations as part of the SIRS (see Figure 4.1). Results from the groundwater samples will be used to assess the potential presence of a source area and the need, if any, for additional groundwater and soil sampling.

2.6.4 Former Coal Pile

A coal pile was located in the area just east of the Boiler house from approximately 1946 to 1966. Two perimeter monitoring wells (PW-2M and PW-2T) were installed in the vicinity of the former coal pile and have been analyzed for volatile organic compounds. Only low levels of 1,2-dichlorobenzene (19 μg/l to 28 μg/l) and 1,1-dichloroethane (1 μg/l) were detected in the samples. Groundwater samples were not analyzed for polynuclear aromatic hydrocarbons (PAHs).

These wells are being sampled and analyzed for volatile organic compounds as part of the perimeter monitoring program. Samples collected as part of this program should also be analyzed for PAHs to determine if the former coal pile may be impacting groundwater at levels of environmental concern.

2.7 IDENTIFICATION OF STUDY AREAS

Based on the historical information, past land uses, reported major spills, and data from previous investigations, seven Study Areas have been identified which require additional information to determine the presence or absence of contamination at levels of environmental concern and the need for remedial measures. The Study Areas include the following locations:

1. Deteriorated sections of the sanitary sewer system

2. The Building 1 and 4 areas
3. The Building 9 and 24 areas
4. The ST Tank Farm
5. Former drum storage areas 2, 3, 4, 5
6. Former underground fuel oil storage tanks near Building 18
7. The former coal pile

Groundwater data will be collected from the first four Study Areas during the Storm Sewer Contaminant Source Investigation. This data will be included in the Site Investigation and Remediation Study (SIRS). These sampling locations are identified in the SIRS Work Plan (Section 4) for completeness.

TABLE 2.1
CHT TANK FARM AREA
SLUG TEST RESULTS

MONITORING WELL	INJECTION/ WITHDRAWAL	HYDRAULIC CONDUCTIVITY (feet/day)	UNIT SCREENED
CH–1T	INJECTION	0.031	Glacial Till
CH–1T	WITHDRAWAL	0.082	
CH–3TS	INJECTION	NA	Glacial Till
CH–3TS	WITHDRAWAL	NA	
CH–4TS	INJECTION	NA	Glacial Till
CH–4TS	WITHDRAWAL	NA	
CH–5TD	INJECTION	0.353	Glacial Till
CH–5TD	WITHDRAWAL	0.24	

Notes:

Slug tests performed by Dames & Moore in August 1990
Slug tests analyzed by Bouwer and Rice method for unconfined aquifers
NA = Not analyzed due to negligible change in head

TABLE 2.2
BUILDING HISTORY
BRISTOL–MYERS SQUIBB

Bld No.	Year Building Const	Current Use	Past Use	Year Prop. Purch.	Property Purchased From
6	1919	Research and control	Same	1945	National Cellulose Corporation
12	1944	Out of Service (1986)	Corn syrup storage	1945	Reconstruction Finance Corporation
17	1944	Boiler house and compressor room	Same	1945	Reconstruction Finance Corporation
1	1945	Under renovation for penicillin extraction	Chemical production, pilot plants, labs & maintenance	1945	Reconstruction Finance Corporation
2	1945	Boiler house	Same	1945	Reconstruction Finance Corporation
3	1945	Dry product and mechanical storage area, labs	Same	1945	Reconstruction Finance Corporation
6 A	1945	Virology	Same	1945	National Cellulose Corporation
7	1945	Cafeteria	Maintenance garage 1919 – 1960	1945	National Cellulose Corporation
13	1945	Solvent pump house	Same	1945	Reconstruction Finance Corporation
4	1946	Extraction (penicillin)	Same	1945	Reconstruction Finance Corporation
2 A	1947	Boiler house	Same	1945	Reconstruction Finance Corporation
5	1957	Maintenance, laboratories, fermentation development	Same plus sterile filling	1945	Reconstruction Finance Corporation
8	1947	Fermentation production	Same	1945	Reconstruction Finance Corporation
9	1947	Extraction (Kanamycin & Splitting)	Same	1945	Frank J. Cregg, Jr.
14	1947	Electric substation	Same	1945	Reconstruction Finance Corporation
15	1947	Cooling tower pump house	Same	1945	Reconstruction Finance Corporation
20	1949	Dry raw material and product storage	Same	1945	National Cellulose Corporation
4 A	1951	Extraction (penicillin)	Same	1945	Reconstruction Finance Corporation
8 A	1951	Fermentation production	Same	1945	Reconstruction Finance Corporation
18	1951	Out of Service	Fuel oil storage (until 1986)	1945	Reconstruction Finance Corporation
8 B	1952	Fermentation production	Same	1945	Reconstruction Finance Corporation
8 C	1952	Fermentation production, utilities	Same	1945	Reconstruction Finance Corporation
15 A	1952	Tower water pump house	Same	1945	Reconstruction Finance Corporation
21	1952	QC laboratory/maintenance	Same plus sterile filling & packaging	1945	Reconstruction Finance Corporation
22	1952	Administration	Same	1945	Frank J. Cregg, Jr.
9 B	1953	Utilities, offices and labs	Same	1945	Frank J. Cregg, Jr.
9 A	1953	Extraction (Ceph Broth & Kanamycin)	Same	1945	Frank J. Cregg, Jr.
26	1953	Electric substation	Same	1945	National Cellulose Corporation
27	1953	Solvent recovery	Same	1945	Reconstruction Finance Corporation
35	1955	Administration	Same		Syracuse Bradford Corporation
28	1956	Materials control, receiving & traffic control	Same	1955	Thompson Road Realty Corporation
34	1956	Vehicle and electrical equipment storage	Same		Radcliff Construction Co., Inc.
23	1958	Laboratories	Same	1945	National Cellulose Corporation
29	1958	Warehouse–extraction–kanamycin	Same	1945	Frank J. Cregg, Jr.
30	1961	[redacted]	Same	1945	National Cellulose Corporation
5 A	1962	40 PSIG centrif. air compressor, ferm. develop	Same	1945	Reconstruction Finance Corporation
24	1962	Chemical development & engineering	Same	1945	National Cellulose Corporation
24 A	1962	Chemical development pilot plant	Same	1945	National Cellulose Corporation
31	1963	Carpenter shop	Same	1945	Reconstruction Finance Corporation
8 D	1964	Fermentation development	Same	1945	Reconstruction Finance Corporation
19	1964	Yards & grounds	Same		Radcliff Construction Co., Inc.
2 B	1965	Boiler house	Same	1945	Reconstruction Finance Corporation
21 A	1965	Raw material & product dry storage/labs	Same plus sterile filling/packaging	1945	Reconstruction Finance Corporation

TABLE 2.2
BUILDING HISTORY
BRISTOL–MYERS SQUIBB

Bld No.	Year Building Const	Current Use	Past Use	Year Prop. Purch.	Property Purchased From
15 B	1966	Tower water pump house	Same	1945	Reconstruction Finance Corporation
22 A	1966	administration	Same	1945	Frank J. Cregg, Jr.
32	1966	Toxicology laboratories	Same	1948	Agnes G. Roberts
33	1966	Refrigeration (chilled water)	Same	1945	National Cellulose Corporation
4 B	1967	Extraction & chemical prod. (cephalosporin)	Same	1945	Reconstruction Finance Corporation
8 E	1967	Fermentation production	Same	1945	Reconstruction Finance Corporation
23 B	1967	Research Laboratories	Same	1945	National Cellulose Corporation
25	1967	Organic synthesis pilot plant	Same	1945	National Cellulose Corporation
25 A	1967	Dry storage for chemical development	Same	1945	Frank J. Cregg, Jr.
1 A	1968	Water treatment chemical storage (drums)	Drum solvent storage	1945	Reconstruction Finance Corporation
4 C	1968	Electrical for buildings 4 & 4A	Same	1945	Reconstruction Finance Corporation
23 A	1968	Research	Same	1945	National Cellulose Corporation
26 B	1968	Machine oil storage (drums)	Same	1945	National Cellulose Corporation
37	1968	Tower water pump house	Same	1945	Reconstruction Finance Corporation
4 D	1969	Service (brine chiller) for buildings 4 & 4A	Same	1945	Reconstruction Finance Corporation
36	1969	Utilities–chilled water and compressed air for ferment.	Same	1945	Reconstruction Finance Corporation
41	1969	Dry storage	Same	1945	Frank J. Cregg, Jr.
42	1969	Maintenance	Same	1945	Reconstruction Finance Corporation
38	1970	Refrigeration for splitting	Same	1945	Frank J. Cregg, Jr.
40	1970	Ethylene gylcol/methanol brine pumps	Chlorine storage (1–ton cylinders)	1945	Frank J. Cregg, Jr.
43	1975	Dry storage–extraction–penicillin and splitting	Same	1945	Frank J. Cregg, Jr.
20 A	1976	Media slurry building (fermentation)	Same	1945	National Cellulose Corporation
20 B	1976	Railroad car unloading (corn syrup)	Same	1945	National Cellulose Corporation
44	1976	Pnuematic equipment building (fermentation)	Same	1948	Agnes G. Roberts
45	1976	Drum storage shed	Same	1945	Frank J. Cregg, Jr.
46	1977	Mechanical refrigeration	Same	1945	Frank J. Cregg, Jr.
32 A	1978	Research – pharmacology	Same	1945	National Cellulose Corporation
48	1979	[redacted]	Same	1945	Reconstruction Finance Corporation
49	1979	[redacted]	Same	1948	Agnes G. Roberts
50	1979	Truck sampling	Same		James K. Turner & Richard K. O'Dea
51	1979	Administration	Same		Stanley Legawiec & Jane Legawiec
36 A	1980	Utilities–chilled water & compressed air for ferm.	Same	1945	Reconstruction Finance Corporation
52	1980	Control building – solvent recovery	Same	1945	Frank J. Cregg, Jr.
53	1980	Cooling tower pump shed, solvent recovery	Same	1945	National Cellulose Corporation
21 B	1981	Not in use	Distilled water still/ultrafilter pilot	1945	Reconstruction Finance Corporation
54	1981	Electrical equipment building	Same	1945	Reconstruction Finance Corporation
55	1981	Security center	Same	1945	National Cellulose Corporation
56	1981	6APA drying building	Same	1945	Frank J. Cregg, Jr.
59	1982	PCL3 & DDS storage building	Same	1945	Frank J. Cregg, Jr.
58	1983	Fermentation development building	Same		Procul Realty Company, Inc.
57	1985	Corn syrup pump house	Same	1945	Reconstruction Finance Corporation
60	1985	IPA recovery still	Same	1945	Reconstruction Finance Corporation
43 A	1986	Drum storage	Same	1945	Frank J. Cregg, Jr.
61	1986	Fire water pump station	Same	1945	Frank J. Cregg, Jr.

TABLE 2.2
BUILDING HISTORY
BRISTOL–MYERS SQUIBB

Bld No.	Year Building Const	Current Use	Past Use	Year Prop. Purch.	Property Purchased From
32 B	1988	Toxicology	Same	1945	
36 B	1988	Service – chiled cater & compressed air for ferment	Same	1945	
62	1988	Extraction/Filtration and Drying (TITUS)	Same	1945	
63	1988	[redacted]	Same	1945	National Cellulose Corporation
64	1988		Same	1945	National Cellulose Corporation
65	1988		Same	1945	National Cellulose Corporation
66	1989		Same	1945	National Cellulose Corporation
67	1989		Same	1945	National Cellulose Corporation
68	1990		Same	1945	
69	1992		Same	1945	
70	1992	Fire Protection Equipment	Same	1945	
71	1992	Anhydrous Ammonia Tank Building	Same	1945	
58 A	1993	Biologics Pilot Plant	Same	1945	
58 B	1993	Biologics Pilot Plant	Same	1945	
75	1994	Anti–Cancer Development Laboratories	Same	1945	
25 N	1994	Organic Synthesis Pilot Plant	Same	1945	

TABLE 2.3
MAJOR SPILLS AND LEAKS
BRISTOL–MYERS SQUIBB
THOMPSON ROAD FACILITY

Date of Spill	Location of Spill	Type of Waste	Quantitiy Spilled	Cleanup Action
July 25, 1976	Building 18 Fuel Oil Tanks	No. 6 Fuel Oil	2,276 gallons to Ley Creek	Oil booms placed in Ley Creek, oil collected pumped into tank trailers, banks of brook manually cut back
November 7, 1984	Tank CHT–5, CHT Tank Farm	Methanol	4,900 gallons	Drained to sanitary sewer
August 12, 1985	Distillation Column	MIBK	1,500 gallons	Drained to sanitary sewer
October 1986	Tank DS–55, Security Center	Diesel Fuel	Unknown	Holes found in bottom of tank, tank was excavated and removed along with all stained soils
January 7, 1986	Tank R–3 near Building 52	MIBK	1,100 gallons	Drained to sanitary sewer
June 6, 1988	Tank CHT–1, CHT Tank Farm	Methanol Methylene Chloride	5,242 gallons	Leaked to soils in CHT vault which drained to the sanitary sewer. Soil and tanks removed, vacuum extraction system installed
October 18, 1988	Tank Oil 2, Boilerhouse	No. 6 Feul Oil	Unknown	During upgrade, oil stained soils encountered, tank and approximately 300 cubic yards of visibly impacted soil was removed
June 30, 1991	Pipe rack near Building 59	Methylene Chloride Methanol DCHA	1,000 gallons	Spill flowed down gravel slope, onto asphalt, into storm sewer and into Ley Creek. Adsorbent matterial placed on asphalt, approximately 40 yards of soil were removed, no visible impacts to Ley Creek observed
July 19, 1991	4B Sump	Butanol MIBK Acetone	Unknown	During an inspection of the sump, a hole was found in the bottom. A new floor was poured in the sump and a soil boringwas conducted just east of the sump. A soil sample was analyzed for TCLP. Results indicated non–detects.
August 16–21, 1991	HEPA Filter Housing, Titus System	Methanol	5,000 gallons	Released to the air. Cracks in the filter housing were repaired and the seal leg was refilled.
July 2, 1992	Building 52, Solvent Recovery	MIBK	2,500 gallons	Drained to sanitary sewer

TABLE 2.4
SUMMARY OF SOIL ANALYTICAL RESULTS
CHT TANK FARM

BORING NO.	SAMPLE NO.	DEPTH (feet)	USEPA METHOD	METHANOL (mg/kg)	METHYLENE CHLORIDE (mg/kg)	MIBK (mg/kg)
CHTF-2T	10	18.0-18.7	8015 (DAI) 9240 (GCMS)	ND	1.1	0.010
CHTF-2T	11	20.0-20.7	8015 (DAI) 9240 (GCMS)	ND	3.9	ND
CHTF-2T	12	22.0-22.8	8015 (DAI) 9240 (GCMS)	ND	108.0	0.042

NOTE:

ND = Not Dectected

TABLE 2.5
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS
CHT TANK FARM WELLS
ROUNDS 1 AND 2

			ROUND 1 FEB.2,1990			ROUND 2 AUG. 2, 1990		
MONITORING WELL	LABORATORY	USEPA METHOD	METHANOL (mg/l)	METHYLENE CHLORIDE (mg/l)	MIBK (mg/l)	METHANOL (mg/l)	METHYLENE CHLORIDE (mg/l)	MIBK (mg/l)
6 NYCRR Part 703 Class GA Ground Water Standards			0.05	0.005	0.05	0.05	0.005	0.05
CH-1M	GALSON	8015 (DAI)	ND			ND		
	GALSON	8240 (GCMS)		ND	ND		ND	ND
	RECRA	8015 (DAI)				ND		
	RECRA	8240 (GCMS)					ND	ND
CH-1T	GALSON	8015 (DAI)	ND			ND		
	GALSON	8240 (GCMS)		ND	ND		ND	ND
	RECRA	8015 (DAI)				ND		
	RECRA	8240 (GCMS)					ND	ND
CH-2M	GALSON	8015 (DAI)	ND			ND		
	GALSON	8240 (GCMS)		ND	ND		ND	ND
	RECRA	8015 (DAI)				ND		
	RECRA	8240 (GCMS)					ND	ND
CH-2T	GALSON	8015 (DAI)	ND			ND		
	GALSON	8240 (GCMS)		13200	ND		13400	ND
	RECRA	8015 (DAI)	1.5			2.8		
	RECRA	8240 (GCMS)		11000	ND		9400	ND
CH-2TD	GALSON	8015 (DAI)				ND		
	GALSON	8240 (GCMS)					16.0	ND
	RECRA	8015 (DAI)				ND		
	RECRA	8240 (GCMS)					16.0	ND
CH-3F	GALSON	8015 (DAI)				ND		
	GALSON	8240 (GCMS)					ND	ND
	RECRA	8015 (DAI)				ND		
	RECRA	8240 (GCMS)					ND	ND
CH-3TS	GALSON	8015 (DAI)				ND		
	GALSON	8240 (GCMS)					ND	ND
	RECRA	8015 (DAI)				ND		
	RECRA	8240 (GCMS)					ND	ND
CH-4TS	GALSON	8015 (DAI)				ND		
	GALSON	8240 (GCMS)					ND	ND
	RECRA	8015 (DAI)				ND		
	RECRA	8240 (GCMS)					ND	ND
CH-4TD	GALSON	8015 (DAI)				ND		
	GALSON	8240 (GCMS)					ND	ND
	RECRA	8015 (DAI)				ND		
	RECRA	8240 (GCMS)					ND	ND
CH-5TS	GALSON	8015 (DAI)				ND		
	GALSON	8240 (GCMS)					ND	ND
	RECRA	8015 (DAI)				ND		
	RECRA	8240 (GCMS)					ND	ND
CH-5TD	GALSON	8015 (DAI)				ND		
	GALSON	8240 (GCMS)					ND	ND
	RECRA	8015 (DAI)				ND		
	RECRA	8240 (GCMS)					ND	ND

NOTE:
ND = Not Detected

TABLE 2.6
GROUNDWATER ANALYTICAL SUMMARY
METHYLENE CHLORIDE CONCENTRATIONS
CHT TANK FARM WELLS

WELL NUMBER	Units	Date Sampled 02/02/90	08/02/90	07/22/91	02/18/91	03/18/92	04/30/92	06/02/92	11/13/92	11/04/93
NYSDEC Class GA Groundwater Standard		0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Extraction Wells										
CH-2T	mg/l	13,200	13,400		650	1,600	10	54	Dry	1,900
CH-2TD	mg/l		16				2	0.0078	47	5
CH-10T	mg/l					2,470	230	180	440	1,300
Air Inlet Wells										
CH-6T	mg/l			1		1	--	--	--	--
CH-7T	mg/l			0.18		--	0.0013	--	--	--
CH-7F	mg/l								0.054	--
CH-8T	mg/l			243		330	48	0.02	500	53
CH-9T	mg/l			0.17		--	0.0017	--	--	--
CH-11T	mg/l					44	20	12	--	0.036
Monitoring Wells										
CH-1M	mg/l	--	--						--	--
CH-1T	mg/l	--	--						--	--
CH-2M	mg/l	--	--						0.007	0.001
CH-3F	mg/l		--						--	--
CH-3TS	mg/l		--						--	--
CH-4TS	mg/l		--						--	--
CH-4TD	mg/l		--						0.009	--
CH-5TS	mg/l		--						0.006	--
CH-5TD	mg/l		--						--	--

Notes:

-- Not Detected

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TABLE 2.7
SUMMARY OF SOIL GAS RESULTS
UPPER MAIN TANK FARM

Sample Location	Depth	Peak Reading	Stabilized Reading
SG-1	3.6	4.5	0.6 - 1.0
SG-2	3.0	1.4	.2
SG-3	3.0	2.2	1.4
SG-4	3.0	1.8	1.4
SG-5	3.0	11.8	2.2
SG-6	3.0	21.6	2.6
SG-7	3.0	13.3	5.3
SG-8	3.0	1.4	1.0
SG-9	3.0	11.8	4.1
SG-10	3.0	4.9	3.0
SG-11	3.0	8.4	1.4
SG-12	3.0	0.0	0.0
SG-13	2.0	0.0	0.0
SG-14	2.0	11.8	0.0
SG-15	2.0	7.3	5.7
SG-16	2.0	4.8	2.2
SG-17	1.4	9.6	2.4
SG-18	2.0	5.3	3.0
SG-19	2.0	1249.0	NA
SG-20	1.5	24.6	18.0
SG-21	1.0	21.5	2.2
SG-22	2.0	3.0	3.6
SG-23	1.5	16.0	---
SG-24	2.0	14.6	5.0
SG-25	1.8	---	0.8
SG-26	2.0	14.6	2.9
SG-27	2.0	6.0	0.0
SG-28	2.0	4.0	0.0
SG-29	2.0	14.6 - 10	0.0
SG-30	2.0	10.4	8.7 - 8.0
SG-31	1.8	5.0	0.0
SG-32	2.0	0.0	0.0
SG-33	1.7	0.0	0.0
SG-34	2.0	0.0	0.0
SG-35	2.0	0.0	0.0
SG-36	2.0	0.0	0.0
SG-37	2.0	0.0	0.0
SG-38	2.0	0.0	0.0
SG-39	2.0	0.0	0.0
SG-40	2.0	0.0	0.0
SG-41	2.0	0.0	0.0
SG-42	3.0	0.0	0.0
SG-43	2.0	16.0	0.0
SG-44	2.0	0.0	0.0
SG-45	2.0	11.0	0.0
SG-46	2.0	5.7	4.7
SG-47	2.0	4.5	2.9
SG-48	2.0	4.9	0.9
SG-49	2.0	4.9	0.0
SG-50	2.0	1.7	1.3
SG-51	2.0	0.0	0.0
SG-52	3.0	3.3	2.5
SG-53	3.0	2.1	1.3 - 1.7

NOTES: SG-19 - Reading peaked at 1249 prior to drawing in water
SG-22 - Residue on Soil Gas Probe
SG-23 - No stabilized reading due to water in flask
SG-25 - No peak reading recorded due to water in flask

TABLE 2.8
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS
LOWER MAIN TANK FARM
ROUND 1, ROUND 1 RESAMPLING, ROUND 2, ROUND 3, AND ROUND 4

			tert-BUTANOL (mg/l)				
MONITORING WELL	LABORATORY	USEPA METHOD	ROUND 1 (12/8/89)	ROUND 1 RESAMPLING (1/19/90)	ROUND 2 (4/26/90)	ROUND3 (8/2/90)	ROUND4 (11/7/90)
6 NYCRR Part 703 Class GA Ground Water Standard			0.050	0.050	0.050	0.050	0.050
LMTF-1M	GENERAL	8240 (GCMS)	0.063	0.2 U			
	GALSON	8240 (GCMS)	0.030	0.082 J	0.1 U	0.053 J	0.1 U
	RECRA	8240 (GCMS)	NA	0.1 J	0.1 U	0.1 U	0.1 U
LMTF-1T	GENERAL	8240 (GCMS)	0.704	0.208			
	GALSON	8240 (GCMS)	0.110	0.190	0.170	0.130	0.210
	RECRA	8240 (GCMS)	NA	0.170	0.230	0.250	0.170
LMTF-2M	GENERAL	8240 (GCMS)	0.022	0.2 U			
	GALSON	8240 (GCMS)	0.020	0.1 U	0.1 U	0.1 U	0.1 U
	RECRA	8240 (GCMS)	NA	0.1 U	0.1 U	0.1 U	0.1 U
LMTF-2T	GENERAL	8240 (GCMS)	0.302	0.566			
	GALSON	8240 (GCMS)	0.230	0.600	0.370	0.360	0.500
	RECRA	8240 (GCMS)	NA	0.410	0.460	0.560	0.330
LMTF-3M	GENERAL	8240 (GCMS)	0.05 U	0.2 U			
	GALSON	8240 (GCMS)	0.05 U	0.045 J	0.1 U	0.1 U	0.1 U
	RECRA	8240 (GCMS)	NA	0.1 U	0.1 U	0.1 U	0.1 U
LMTF-3T	GENERAL	8240 (GCMS)	0.376	0.390			
	GALSON	8240 (GCMS)	0.140	0.320	0.220 JD	0.210	0.310
	RECRA	8240 (GCMS)	NA	0.240	0.350	0.300	0.210

NOTE:
J = Estimated value. Value is below the compound quatitation limit.
D = Diluted value.
U = Compound not detected above the compound quantitation limits.

TABLE 2.9
PERIMETER WELLS
GROUNDWATER ANALYTICAL SUMMARY

PARAMETER	NYSDEC	PW-2T				PW-3T				PW-3MD			
	WQS (1)	Oct-89	Aug-92	Aug-93	Oct-93	Oct-89	Aug-92	Aug-93	Oct-93	Oct-89	Aug-92	Aug-93	Oct-93
VOLATILE ORGANICS (ug/l)													
Chloroform	7	NA	--	--	--	NA	--	--	--	NA	--	--	--
1,2-Dichlorobenzene	4.7	NA	28	19	--	NA	--	--	--	NA	--	--	--
1,1-Dichloroethane	5	NA	1	1	--	NA	--	--	--	NA	2	2	1
1,2-Dichloroethane	5	NA	--	--	--	NA	--	--	--	NA	--	--	--
Tetrachloroethylene	5	NA	--	--	--	NA	--	--	--	NA	--	--	--
1,1,1-Trichloroethane	5	NA	--	--	--	NA	--	--	--	NA	--	--	--
ALCOHOLS (ug/l)													
Methanol	NS	--	--	--	--	--	--	--	--	--	--	--	--
WET CHEMISTRY (mg/l)													
Chemical Oxygen Demand	NS	NA	110	18	54	NA	360	11	64	NA	27	13	18
Total Phenols	0.001	NA	--	--	--	NA	--	--	--	NA	--	--	--
Sulfate	250	NA	820	800	400	NA	1800	1800	1800	NA	110	120	130
Ammonia, Nitrogen	2	NA	--	0.37	0.22	NA	0.14	0.24	0.41	NA	--	0.34	0.59
Total Phosphorus	NS	NA	0.86	--	0.06	NA	3.4	--	0.43	NA	0.19	--	0.08

-- Not Detected
* Monitoring well dry during sampling
NA Not Analyzed
NS No Standard
(1) Ambient Water Quality Standards and Guidance Values, T.O.G.S. 1.1.1, 10/22/93
G Guidance value
PW-2M and PW-4F were dry during all three sampling rounds

[shaded box] = Exceeds water quality standard

TABLE 2.9 cont
PERIMETER WELLS
GROUNDWATER ANALYTICAL SUMMARY

PARAMETER	NYSDEC WQS (1)	PW-3MS				PW-4T				PW-4LS			
		Oct-89	Aug-92	Aug-93	Oct-93	Oct-89	Aug-92	Aug-93	Oct-93	Oct-89	Aug-92	Aug-93	Oct-93
VOLATILE ORGANICS (ug/l)													
Chloroform	7	NA	--	--	--	NA	--	--	--	NA	--	--	--
1,2-Dichlorobenzene	4.7	NA	--	--	--	NA	--	--	--	NA	--	--	--
1,1-Dichloroethane	5	NA	2	2	--	NA	--	--	--	NA	--	--	--
1,2-Dichloroethane	5	NA	--	--	--	NA	--	--	--	NA	--	--	--
Tetrachloroethylene	5	NA	--	--	--	NA	--	--	--	NA	--	--	--
1,1,1-Trichloroethane	5	NA	--	--	--	NA	--	--	--	NA	--	--	--
ALCOHOLS (ug/l)													
Methanol	NS	--	--	--	--	--	--	--	--	--	--	--	990
WET CHEMISTRY (mg/l)													
Chemical Oxygen Demand	NS	NA	46	18	25	NA	30	13	130	NA	62	29	82
Total Phenols	0.001	NA	--	0.005	--	NA	--	--	--	NA	--	--	--
Sulfate	250	NA	130	130	160	NA	**590**	**610**	**620**	NA	62	51	47
Ammonia, Nitrogen	2	NA	0.15	0.63	0.41	NA	--	0.26	0.2	NA	0.81	1	1.6
Total Phosphorus	NS	NA	0.95	--	0.21	NA	0.32	--	1.5	NA	0.84	--	1.1

-- Not Detected
* Monitoring well dry during sampling
NA Not Analyzed
NS No Standard
(1) Ambient Water Quality Standards and Guidance Values, T.O.G.S. 1.1.1, 10/22/93
G Guidance value
PW-2M and PW-4F were dry during all three sampling rounds

[shaded box] = Exceeds water quality standard

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TABLE 2.9 cont
PERIMETER WELLS
GROUNDWATER ANALYTICAL SUMMARY

PARAMETER	NYSDEC	PW-4LD				PW-5T		PW-6T		PW-6L		PW-6F	
	WQS (1)	Oct-89	Aug-92	Aug-93	Oct-93	Aug-93	Oct-93	Aug-93	Oct-93	Aug-93	Oct-93	Aug-93	Oct-93
VOLATILE ORGANICS (ug/l)													
Chloroform	7	NA	--	--	--	--	--	--	--	3	--	--	--
1,2-Dichlorobenzene	4.7	NA	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	5	NA	--	--	--	--	--	--	--	2	--	--	--
1,2-Dichloroethane	5	NA	--	--	--	--	--	--	--	**6**	--	--	--
Tetrachloroethylene	5	NA	--	--	--	--	--	--	--	2	--	--	--
1,1,1-Trichloroethane	5	NA	--	--	--	--	--	--	--	**11**	--	--	--
ALCOHOLS (ug/l)													
Methanol	NS	--	--	--	--	--	--	--	--	--	--	--	--
WET CHEMISTRY (mg/l)													
Chemical Oxygen Demand	NS	NA	32	--	130	510	540	47	150	78	120	110	*
Total Phenols	0.001	NA	--	--	--	0.005	--	--	--	--	--	--	*
Sulfate	250	NA	200	210	0	**1500**	**1200**	**1800**	**1900**	**470**	**800**	62	*
Ammonia, Nitrogen	2	NA	0.05	0.3	--	1.1	0.84	**2.8**	1.6	**2.1**	1.1	**24**	*
Total Phosphorus	NS	NA	0.36	--	1.9	--	11	29	4	1.4	1.9	2.5	*

-- Not Detected
* Monitoring well dry during sampling
NA Not Analyzed
NS No Standard
(1) Ambient Water Quality Standards and Guidance Values, T.O.G.S. 1.1.1, 10/22/93
G Guidance value
PW-2M and PW-4F were dry during all three sampling rounds

[shaded box] = Exceeds water quality standard

TABLE 2.10
NOTCH WELLS
GROUNDWATER ANALYTICAL SUMMARY

PARAMETER	NYSDEC WQS (1)	MW35-1		MW35-2		MW35-3		MW77-1		MW77-2		MW77-3	
		Aug-93	Oct-93	Aug-93	Oct-93	Aug-93	Oct-93	Aug-93	Oct-93	Aug-93	Oct-93	Aug-93	Oct-93
VOLATILE ORGANICS (ug/l)													
Chlorobenzene	5	9	10	*	*	*	*	--	--	*	--	--	--
Acetone	50 (G)	--	--	*	*	*	*	--	--	*	190	--	--
Methyl Isobutyl Ketone	NS	--	--	*	*	*	*	--	16	*	--	--	--
ALCOHOLS (ug/l)													
Methanol	NS	--	--	*	*	*	*	--	--	*	--	--	--
WET CHEMISTRY (mg/l)													
Chemical Oxygen Demand	NS	190	*	*	*	*	*	250	140	*	*	260	91
Total Phenols	0.001	--	*	*	*	*	*	--	--	*	*	--	--
Sulfate	250	200	*	*	*	*	*	38	420	*	*	22	29
Ammonia, Nitrogen	2	2.7	*	*	*	*	*	0.62	1.1	*	*	0.71	0.39
Total Phosphorus	NS	--	*	*	*	*	*	--	0.84	*	*	--	0.66

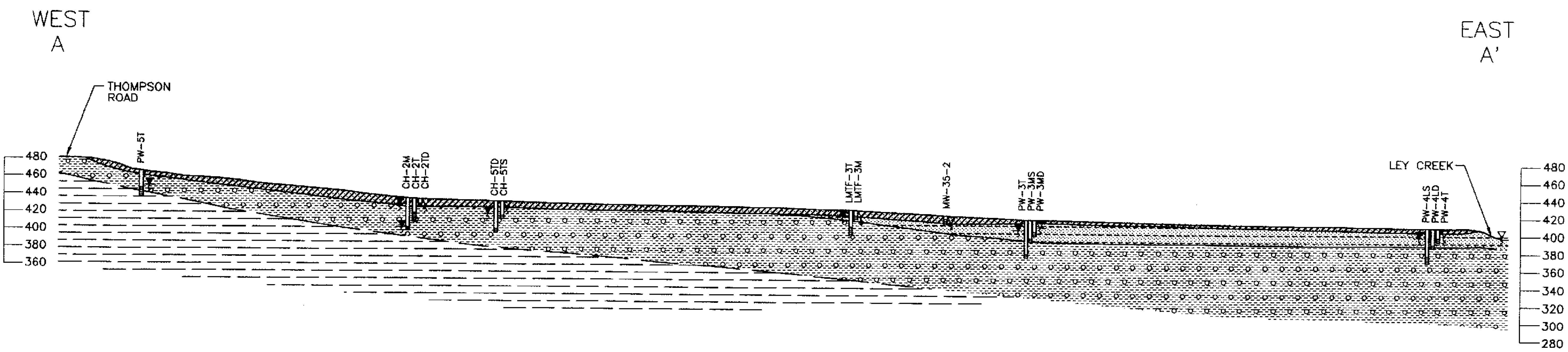
-- Not Detected
* Monitoring well dry during sampling
NA Not Analyzed
NS No Standard
(1) Ambient Water Quality Standards and Guidance Values, T.O.G.S. 1.1.1, 10/22/93
(G) Guidance value

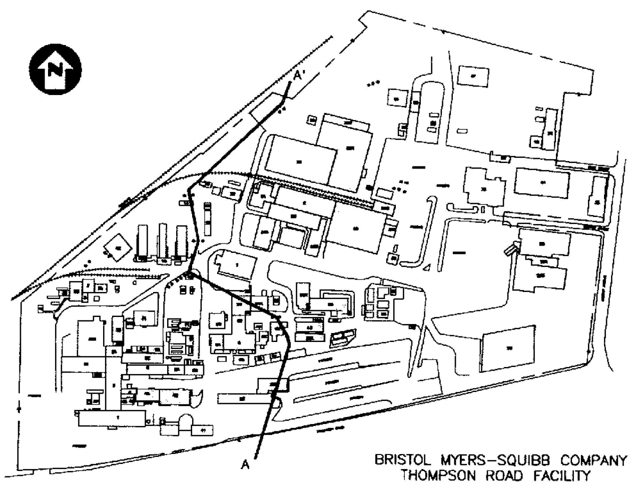
[shaded box] = Exceeds groundwater quality standard

GENERALIZED STRATIGRAPHIC COLUMN
BRISTOL–MYERS SQUIBB
THOMPSON ROAD SITE

LITHOLOGY	UNIT	DESCRIPTION
	FILL	Brown gravel with varying amounts of sand, silt, and clay with occaisional wood, asphalt, cinders, ash, bricks, concrete fragments
	MARSH	Dark, organic–rich silty clay
	GLACIO–LACUSTRINE DEPOSITS	Brown to gray, medium to fine grained sands, silts, and clays exhibiting thin laminations and fining upward sequences.
	VERNON TILL	Very dense, red–brown silty clay and gravel with some fine to coarse sand, pebbles are oriented at low angles to the bedding
	CAMILLUS SHALE	Olive–green, weathered shale with interbeds of gypsum

FIGURE 2.1b





BRISTOL MYERS-SQUIBB COMPANY
THOMPSON ROAD FACILITY
CROSS SECTION
LOCATION PLAN

11/2/94
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LEGEND

- FILL
- GLACIO-LACUSTRINE
- VERNON TILL
- BEDROCK (CAMILLUS SHALE)
- SCREENED INTERVAL
- GROUNDWATER ELEVATION IN TILL (IN FEET ABOVE MEAN SEA LEVEL)
- GROUNDWATER ELEVATION IN GLACIO-LACUSTRINE/FILL (IN FEET ABOVE MEAN SEA LEVEL)

HORIZONTAL SCALE
100' 50' 0 100'
Approximate Scale in Feet

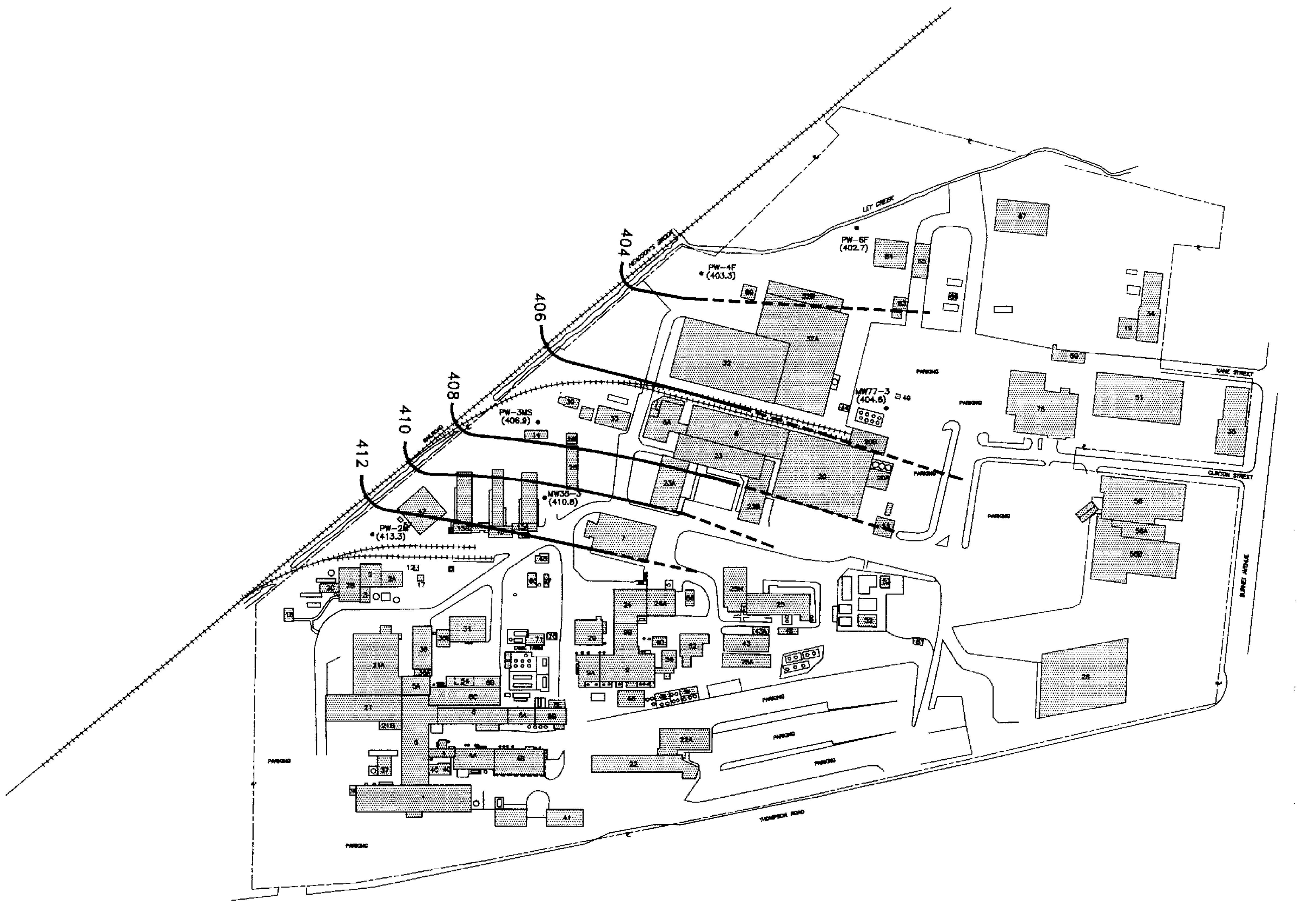
VERTICAL SCALE
40' 20' 0 40'
Approximate Scale in Feet

BRISTOL MYERS-SQUIBB COMPANY

GEOLOGIC
CROSS SECTION A – A'

ENGINEERING-SCIENCE
DESIGN • RESEARCH • PLANNING
SYRACUSE, NEW YORK
ES

FIGURE 2.2



LEGEND

• MONITORING WELL

(402.7) GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL (OCTOBER 20, 1993)

412 ——— WATER LEVEL CONTOURS (DASHED WHERE INFERRED)

—— - —— PROPERTY LINE

250' 0 250'

Approximate Scale in Feet

BRISTOL MYERS-SQUIBB COMPANY
THOMPSON ROAD FACILITY

GROUNDWATER CONTOUR MAP
FILL/LACUSTRINE DEPOSITS

ENGINEERING-SCIENCE
DESIGN • RESEARCH • PLANNING
SYRACUSE, NEW YORK

ES

DATE: 5/26/94
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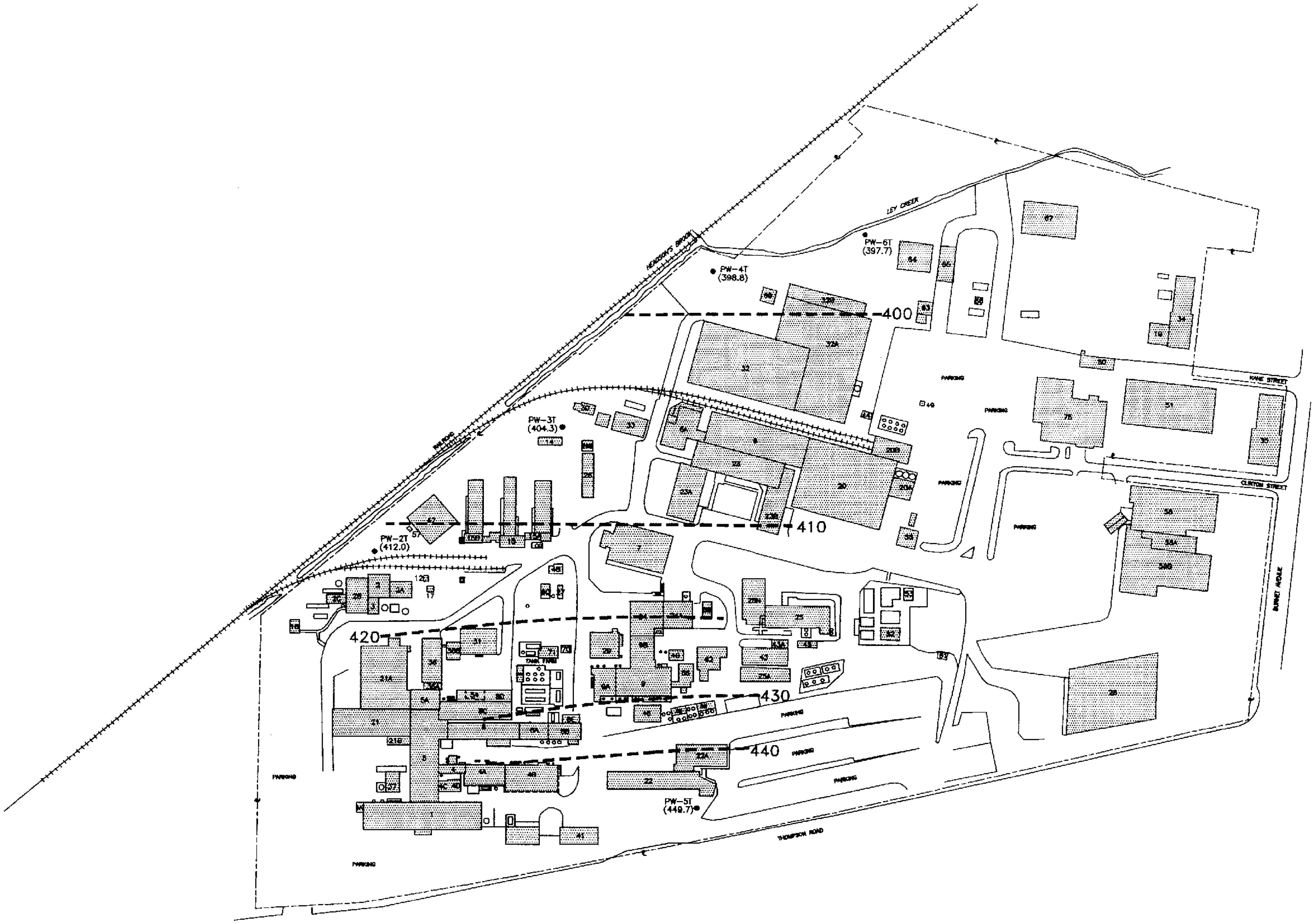
RACER0059567

FIGURE 2.3



LEGEND

• MONITORING WELL

(404.3) GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL (OCTOBER 20, 1993)

400 ——— WATER LEVEL CONTOURS (DASHED WHERE INFERRED)

— - — - — PROPERTY LINE

250' 0 250'

Approximate Scale in Feet

BRISTOL MYERS-SQUIBB COMPANY
THOMPSON ROAD FACILITY

GROUNDWATER CONTOUR MAP
TILL AQUIFER

ENGINEERING-SCIENCE
DESIGN • RESEARCH • PLANNING
SYRACUSE, NEW YORK

ES

DATE: 5/26/94
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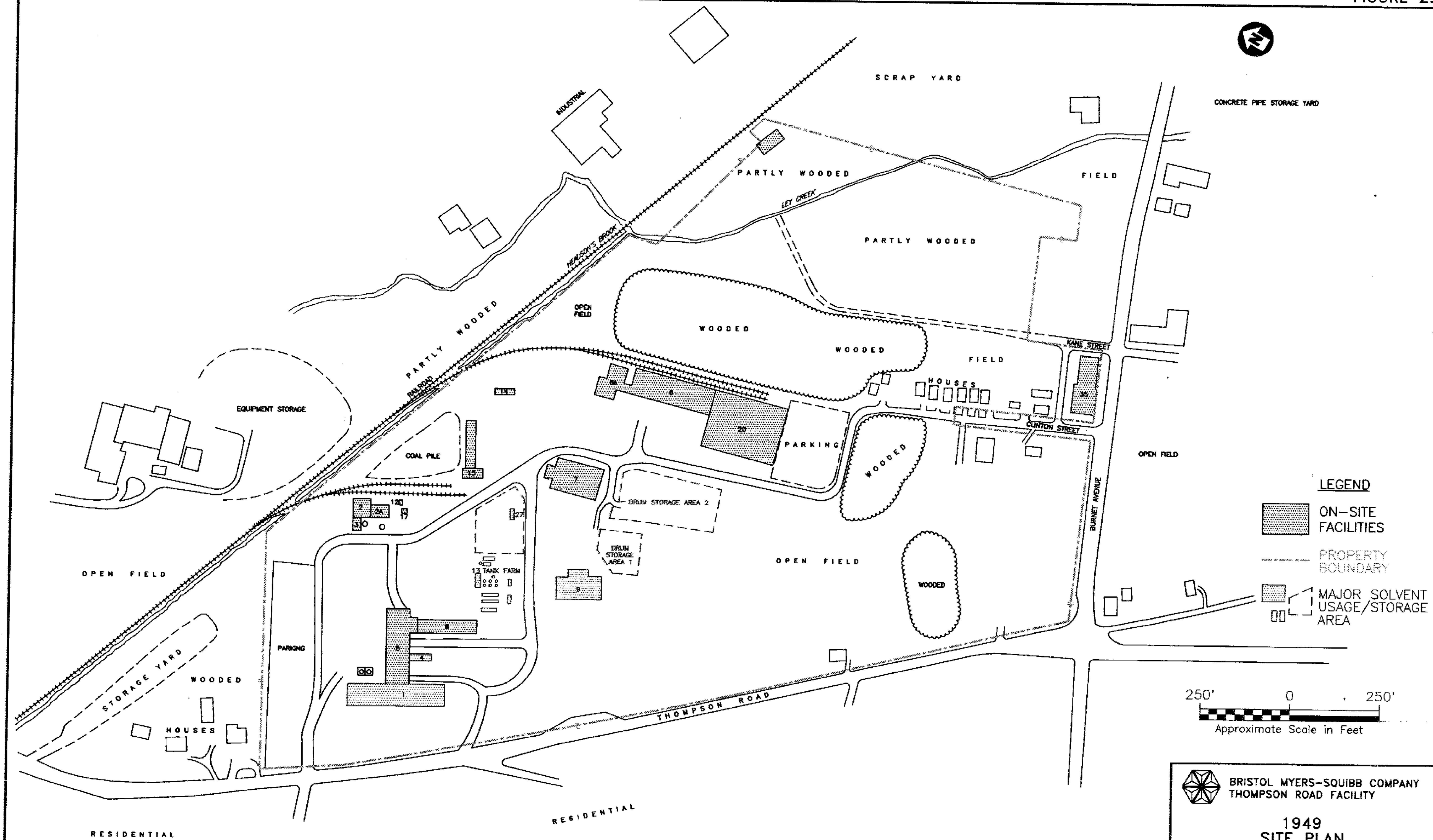
FIGURE 2.4



BRISTOL MYERS-SQUIBB COMPANY
THOMPSON ROAD FACILITY

1949
SITE PLAN

ENGINEERING-SCIENCE
DESIGN • RESEARCH • PLANNING
SYRACUSE, NEW YORK

ES

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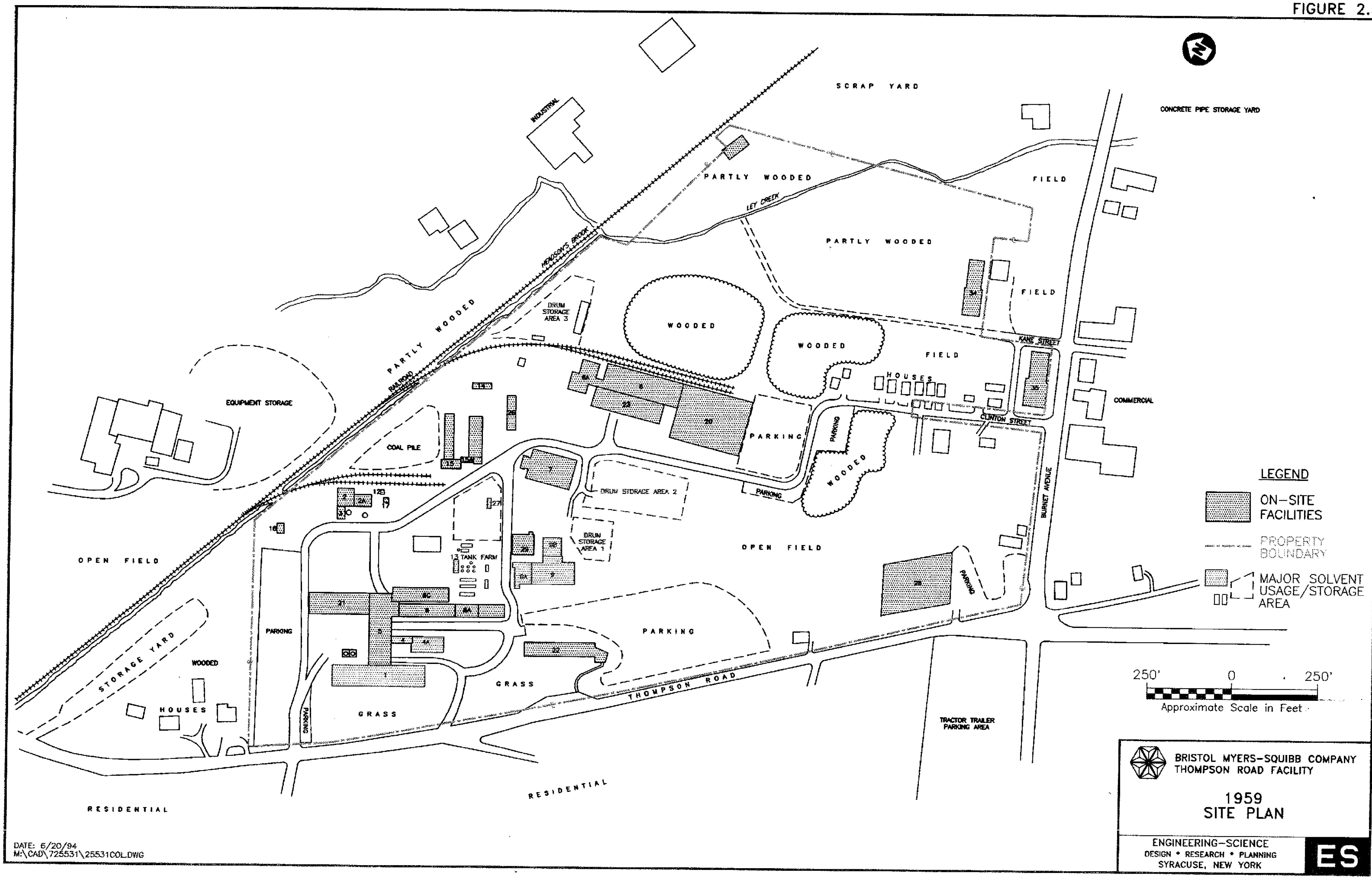
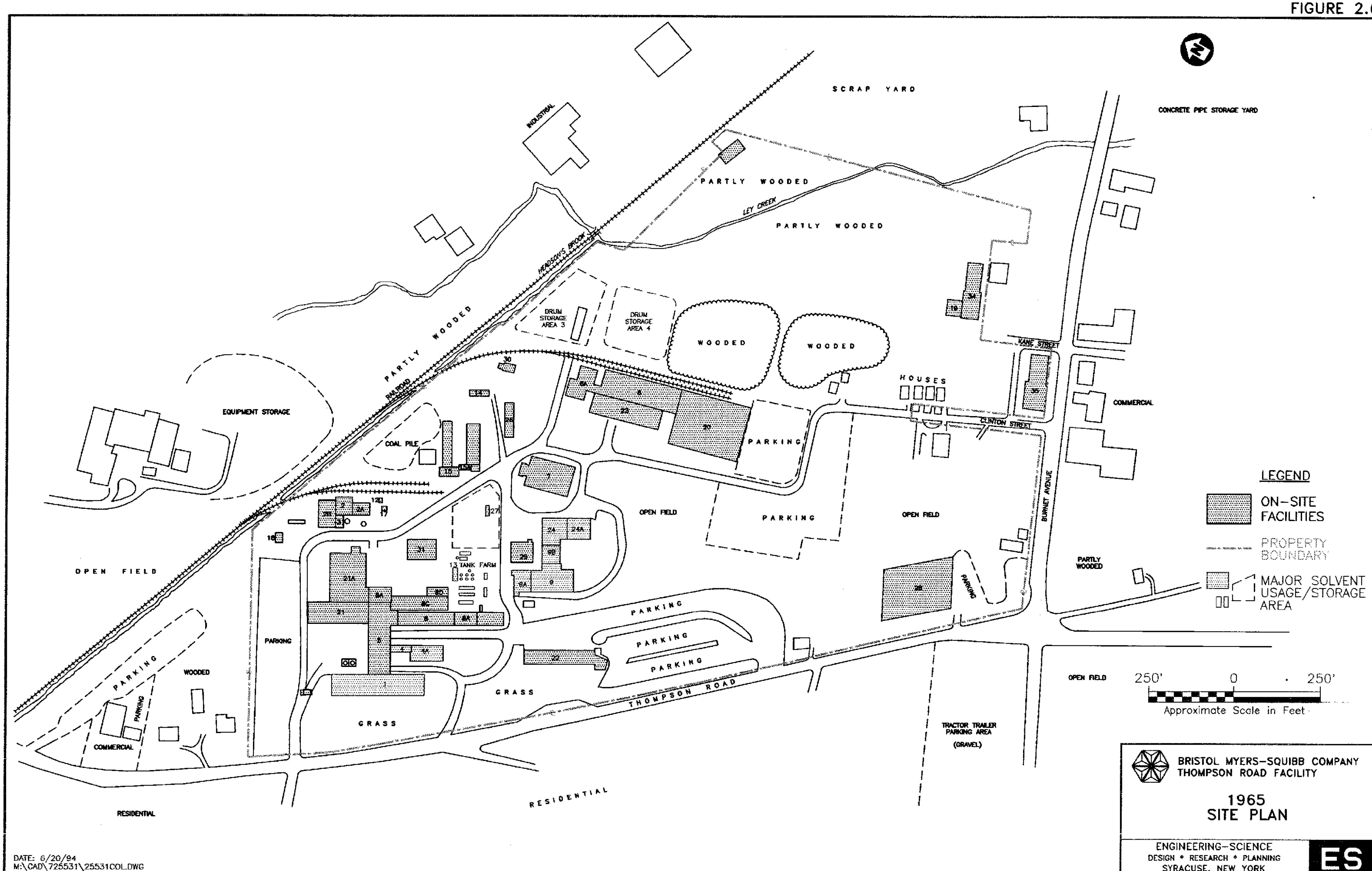
RACER0059569

FIGURE 2.5



RACER0059570

FIGURE 2.6



BRISTOL MYERS-SQUIBB COMPANY
THOMPSON ROAD FACILITY

1965
SITE PLAN

ENGINEERING-SCIENCE
DESIGN * RESEARCH * PLANNING
SYRACUSE, NEW YORK

ES

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RACER0059571

FIGURE 2.7

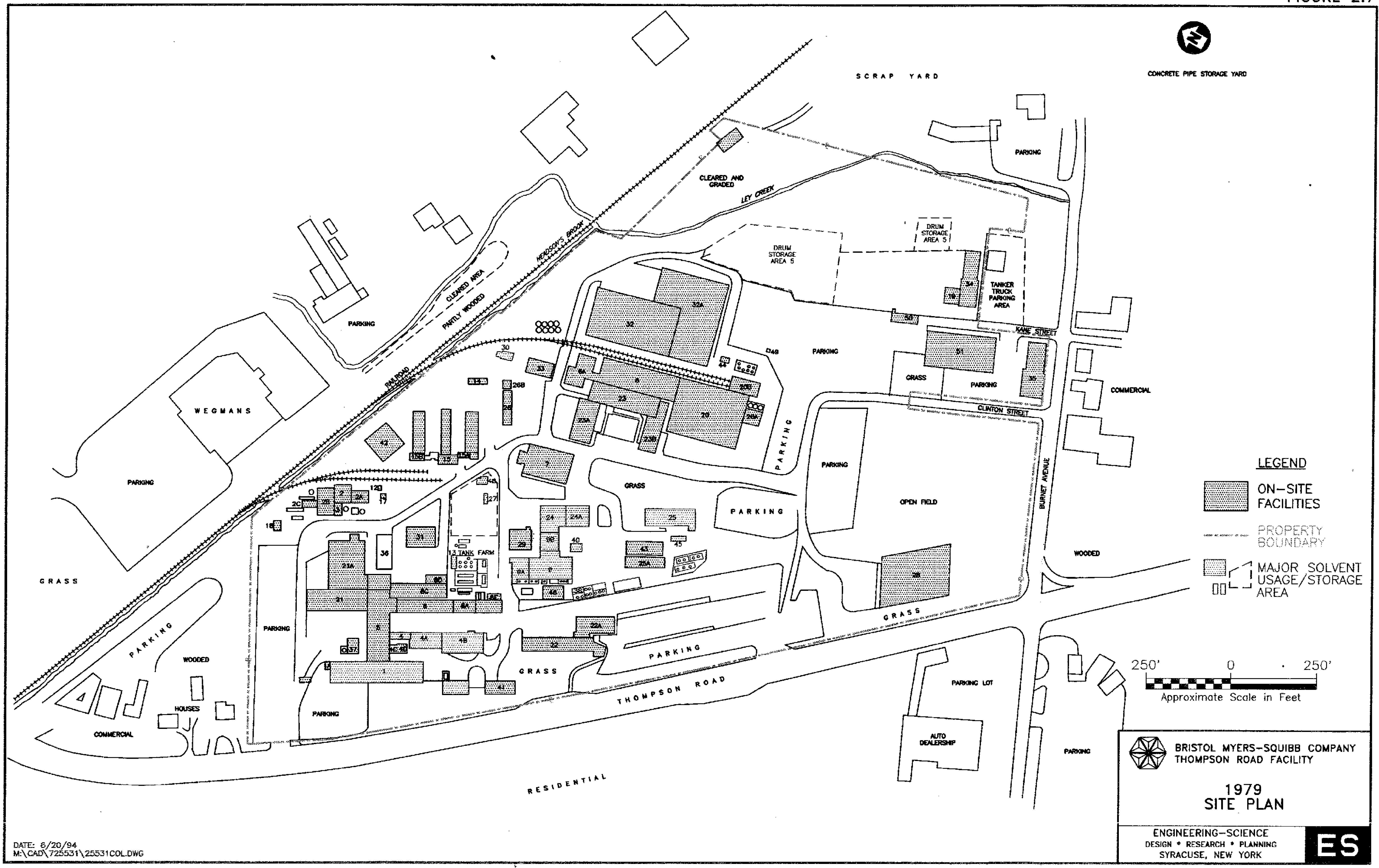
SCRAP YARD
CONCRETE PIPE STORAGE YARD
WEGMANS
PARKING
CLEARED AND GRADED
LEY CREEK
HENDSON'S BROOK
CLEARED AREA
PARTLY WOODED
RAILROAD
DRUM STORAGE AREA 5
TANKER TRUCK PARKING AREA
KANE STREET
CLINTON STREET
BURNET AVENUE
COMMERCIAL
GRASS
OPEN FIELD
WOODED
TANK FARM
THOMPSON ROAD
HOUSES
PARKING LOT
AUTO DEALERSHIP
RESIDENTIAL
LEGEND
ON-SITE FACILITIES
PROPERTY BOUNDARY
MAJOR SOLVENT USAGE/STORAGE AREA
250' 0 250'
Approximate Scale in Feet
BRISTOL MYERS-SQUIBB COMPANY
THOMPSON ROAD FACILITY
1979
SITE PLAN
ENGINEERING-SCIENCE
DESIGN • RESEARCH • PLANNING
SYRACUSE, NEW YORK
ES
DATE: 6/20/94
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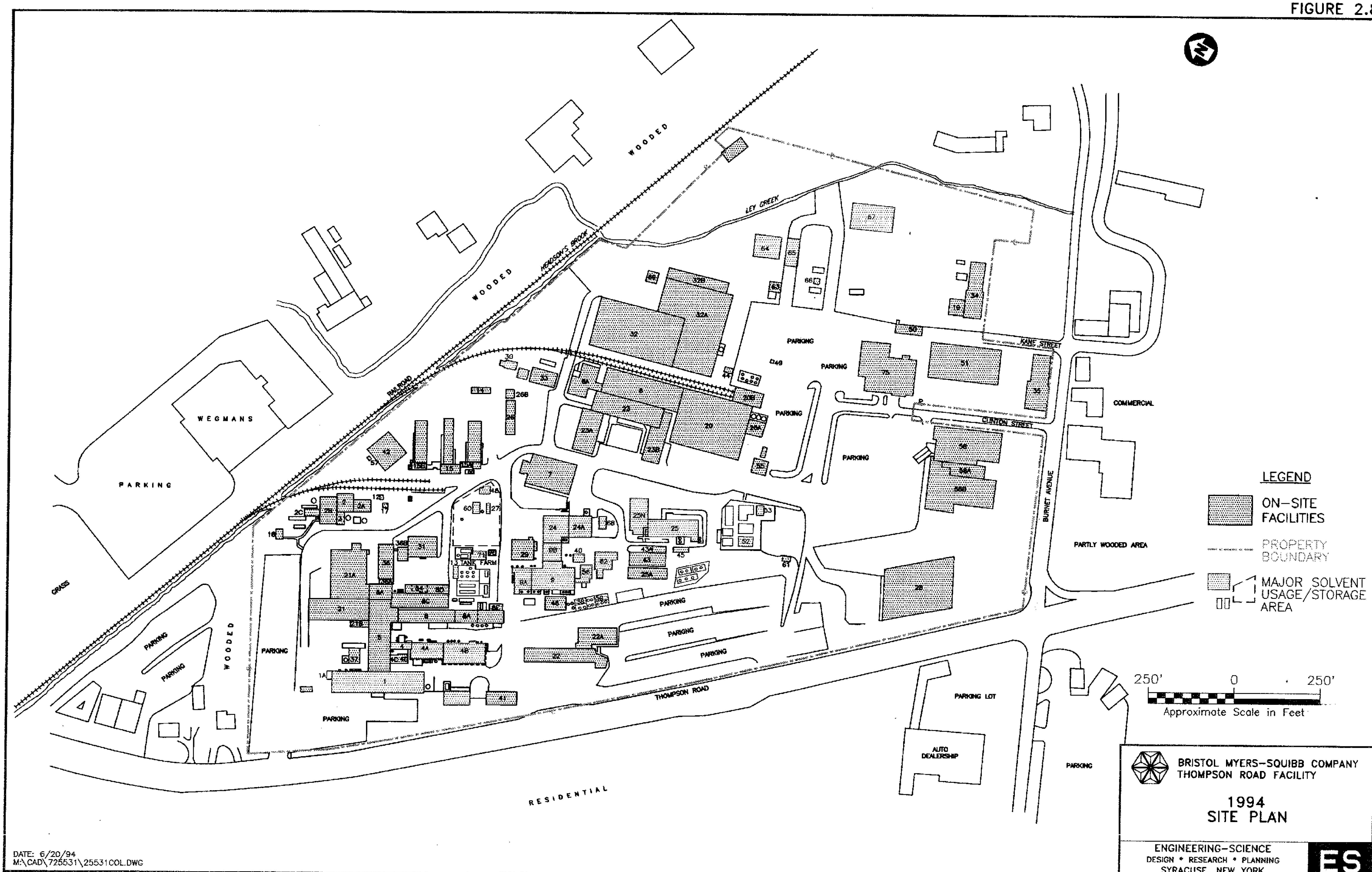
FIGURE 2.8



BRISTOL MYERS-SQUIBB COMPANY
THOMPSON ROAD FACILITY

1994
SITE PLAN

ENGINEERING-SCIENCE
DESIGN • RESEARCH • PLANNING
SYRACUSE, NEW YORK

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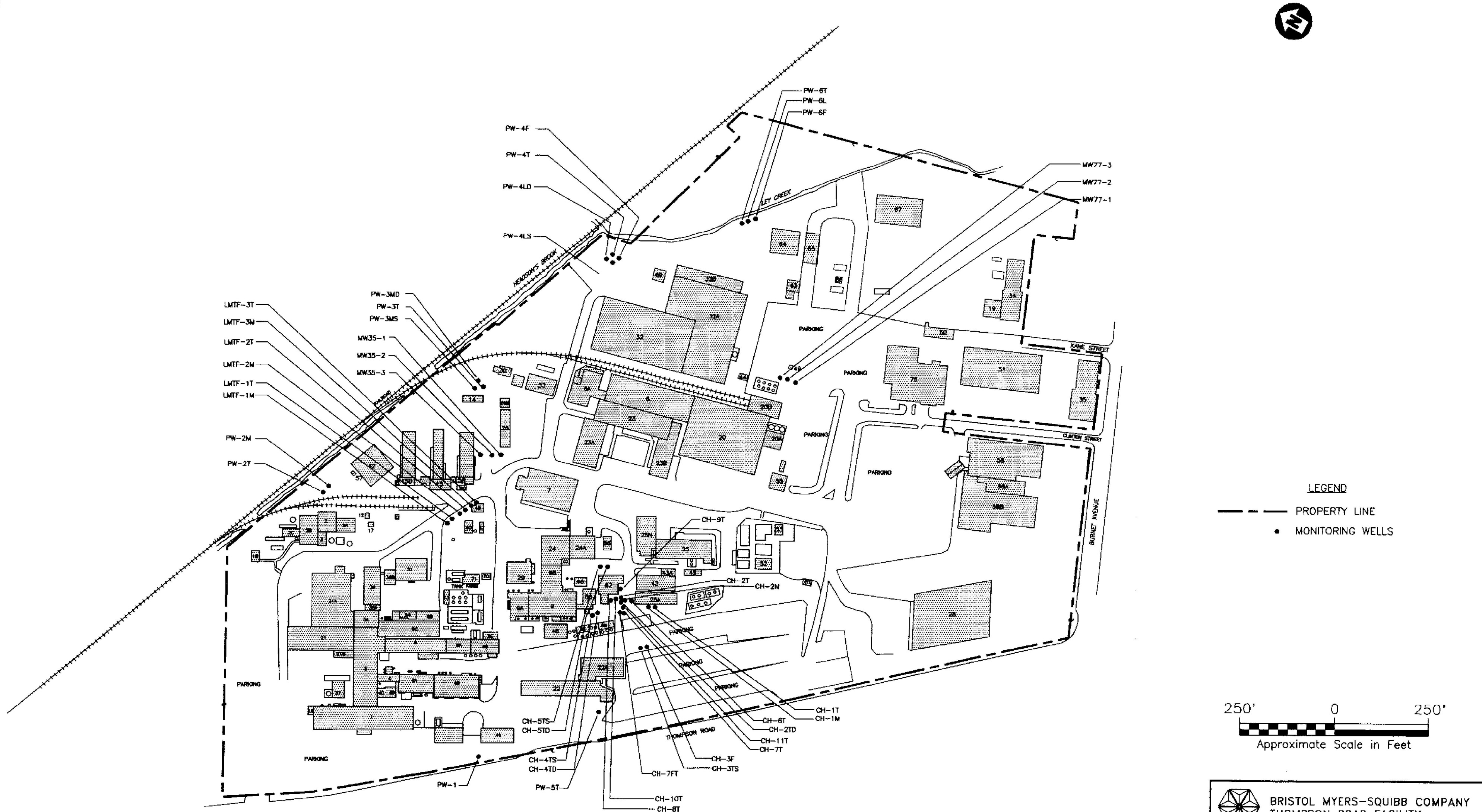
FIGURE 2.9



BRISTOL MYERS-SQUIBB COMPANY
THOMPSON ROAD FACILITY

MONITORING WELL
LOCATION PLAN

ENGINEERING-SCIENCE
DESIGN • RESEARCH • PLANNING
SYRACUSE, NEW YORK

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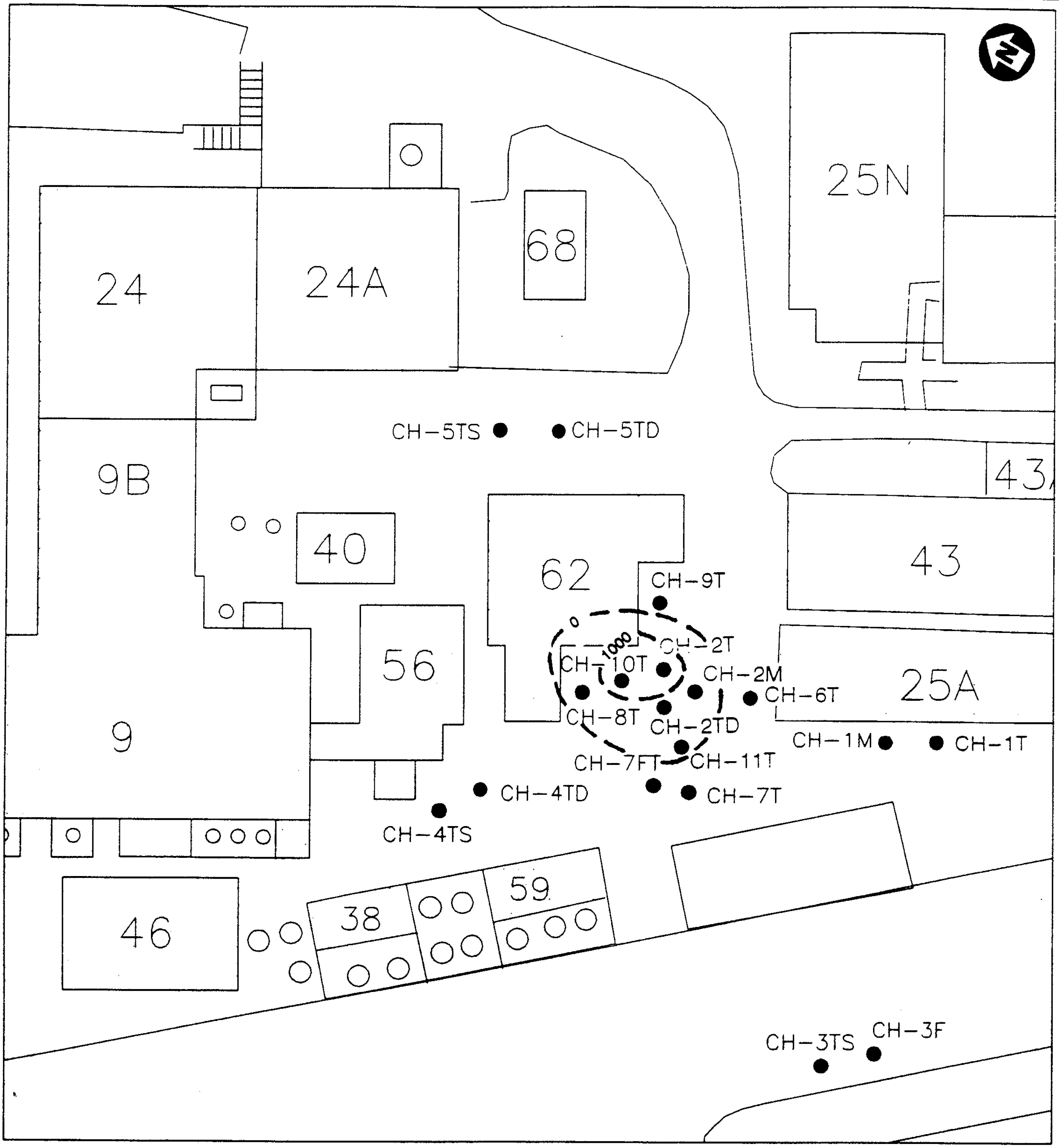

LEGEND

● MONITORING WELL

—100— METHYLENE CHLORIDE ISOCONCENTRATION (ppm)

50' 25' 0 50'

Approximate Scale in Feet

BRISTOL MYERS-SQUIBB COMPANY
THOMPSON ROAD FACILITY

METHYLENE CHLORIDE
ISOCONCENTRATION MAP

FIGURE 2.10

ENGINEERING-SCIENCE
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SYRACUSE, NEW YORK

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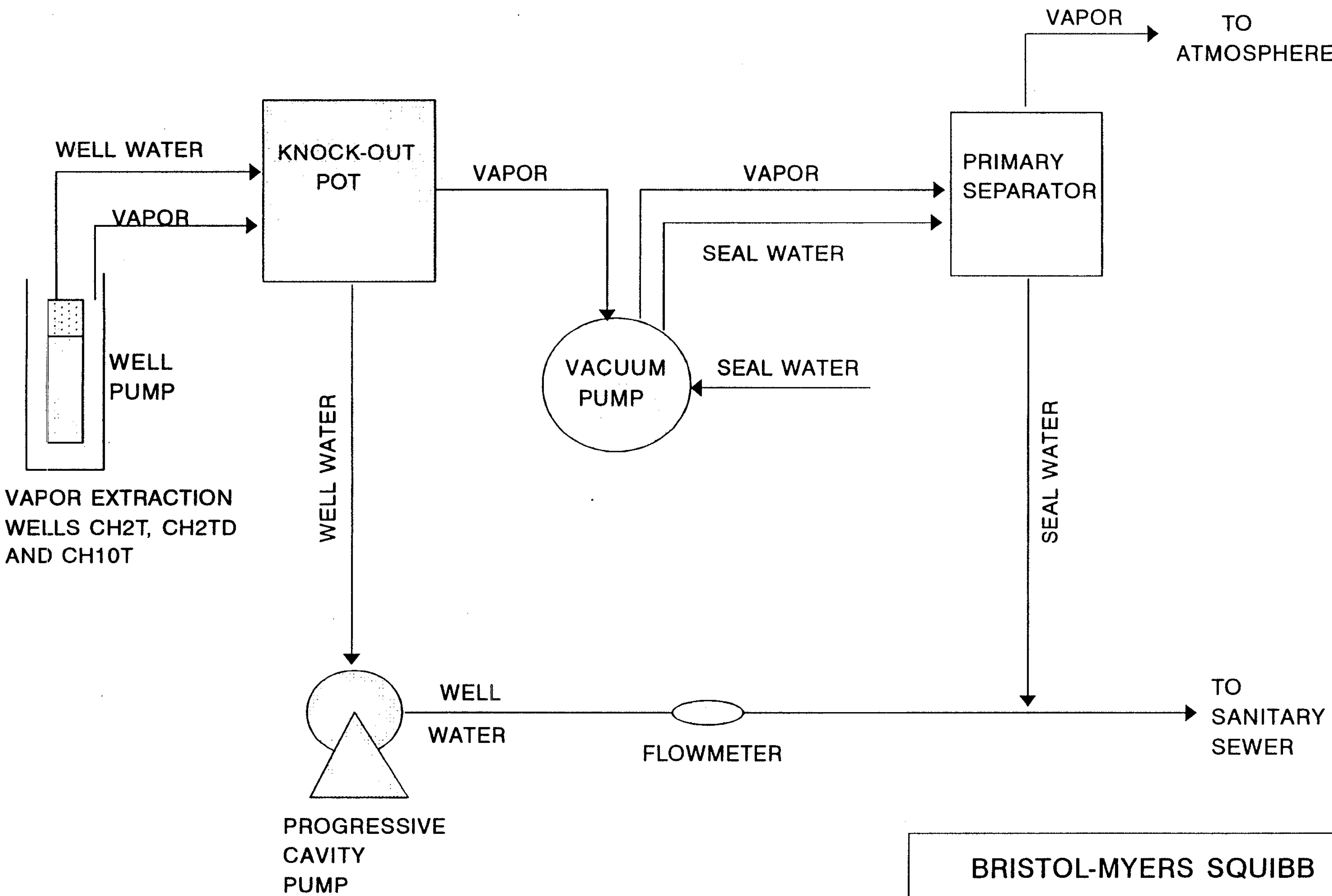
BMSER005957



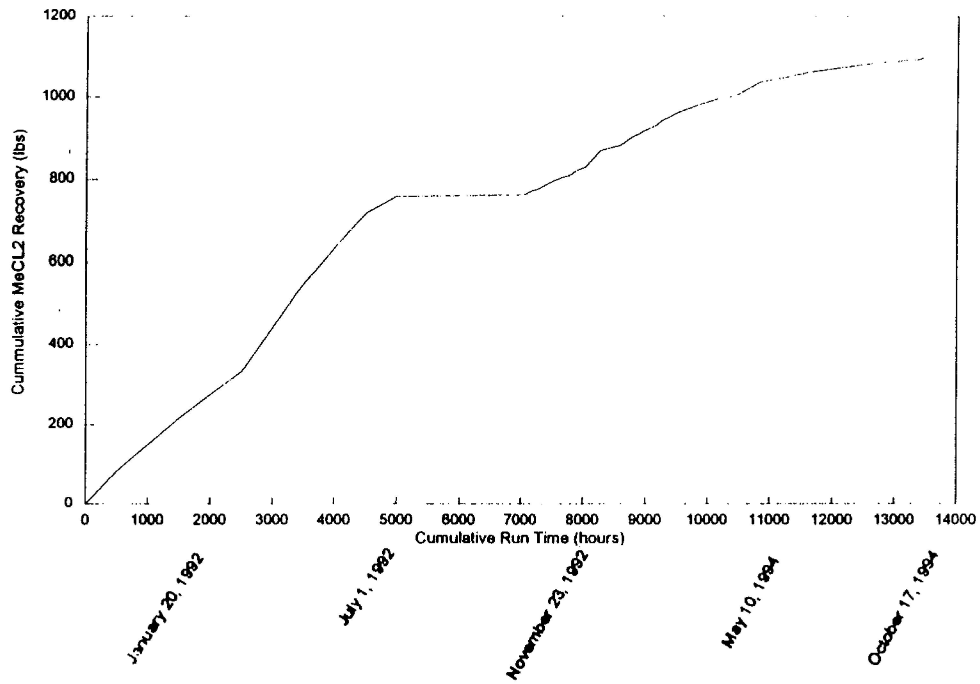
BRISTOL-MYERS SQUIBB

VAPOR EXTRACTION SYSTEM SCHEMATIC

RACER0059576

FIGURE 2.11

METHYLENE CHLORIDE RECOVERY
AIR PHASE

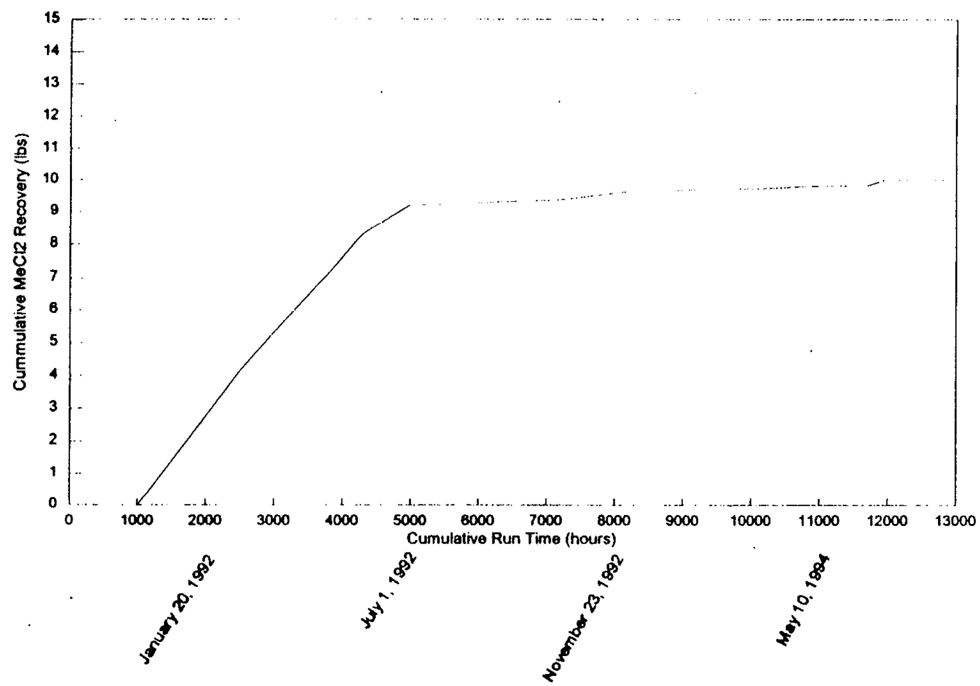


BRISTOL-MYERS SQUIBB COMPANY
THOMPSON ROAD FACILITY

VES PERFORMANCE SUMMARY
AIR PHASE

FIGURE 2.12

METHYLENE CHLORIDE RECOVERY
WATER PHASE



BRISTOL-MYERS SQUIBB COMPANY

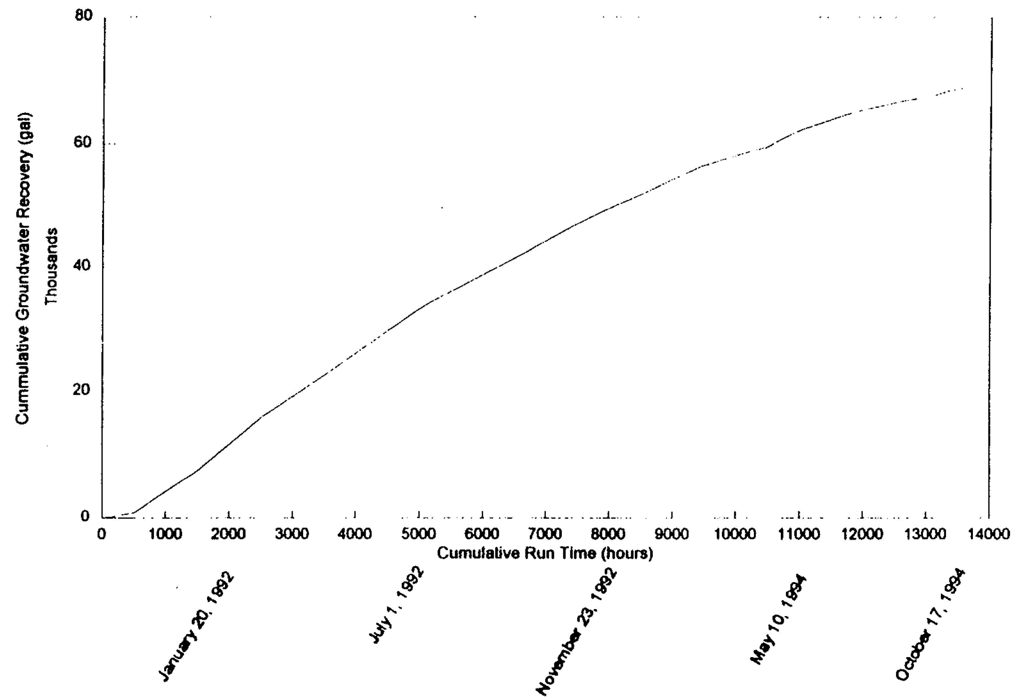
THOMPSON ROAD FACILITY

VES PERFORMANCE SUMMARY

WATER PHASE

FIGURE 2.13

GROUNDWATER RECOVERY



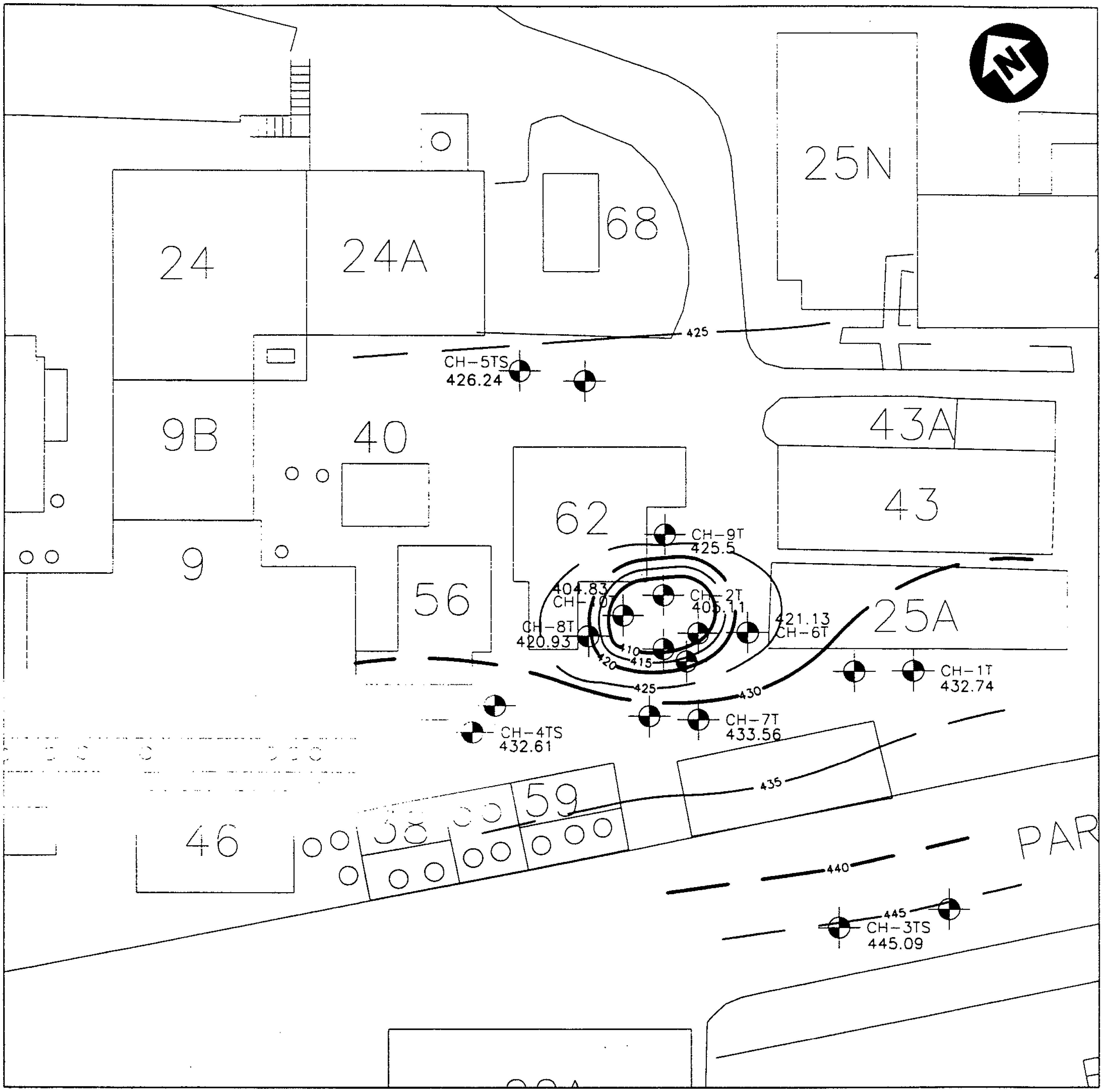
BRISTOL-MYERS SQUIBB COMPANY

THOMPSON ROAD FACILITY

VES PERFORMANCE SUMMARY

GROUNDWATER

FIGURE 2.14



60' 30' 0 60'

Approximate Scale in Feet

LEGEND

CH-2T — MONITORING WELL

—420— GROUNDWATER ELEVATION CONTOUR

FIGURE 2.15

BRISTOL – MYERS SQUIBB COMPANY
THOMPSON ROAD FACILITY
GROUNDWATER ELEVATION CONTOUR MAP
SEPTEMBER – 1994
VES AREA

ENGINEERING-SCIENCE
DESIGN * RESEARCH * PLANNING
SYRACUSE, NEW YORK

ES

10/7/94
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RACER005[illegible]30

FIGURE 2.16

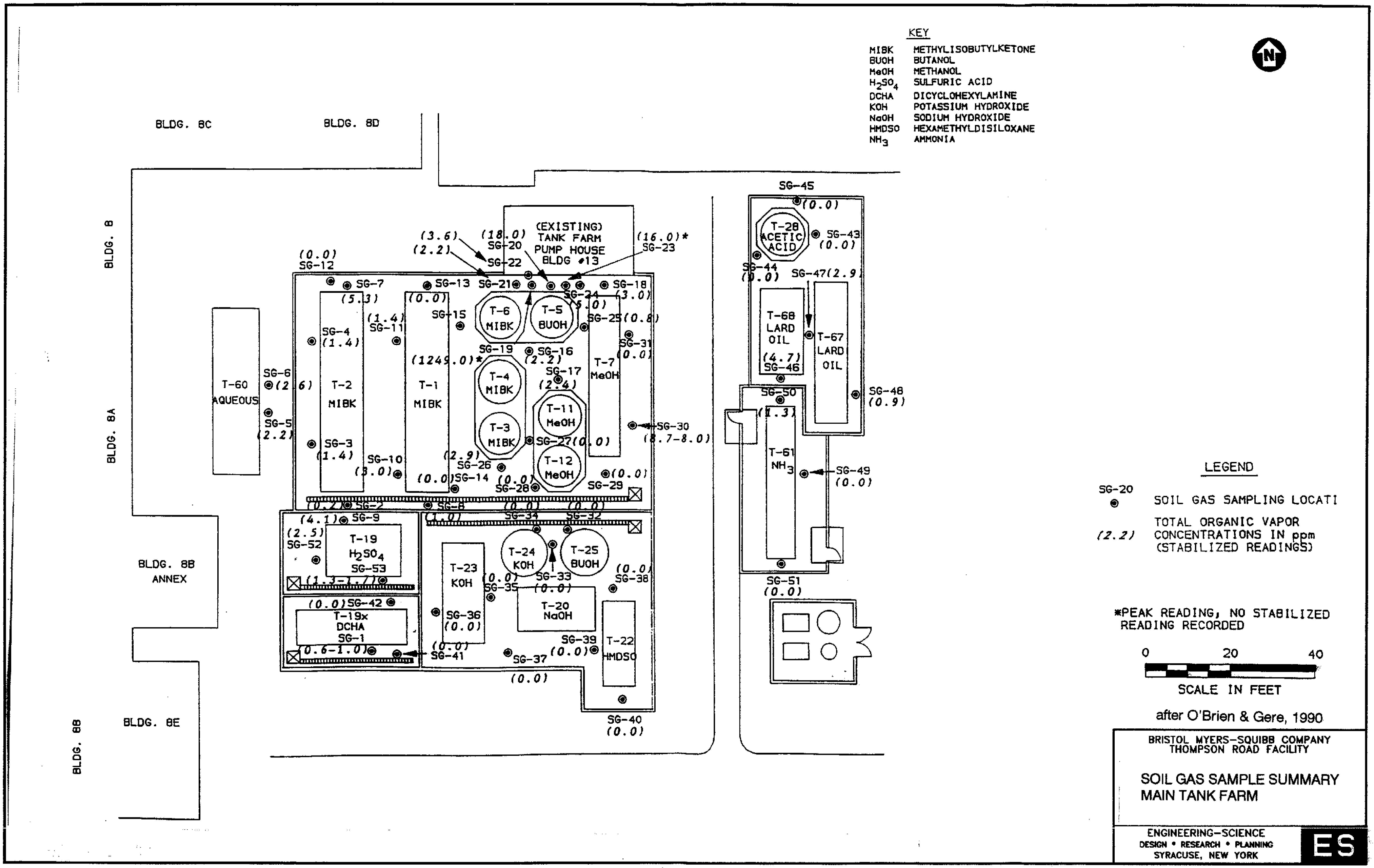

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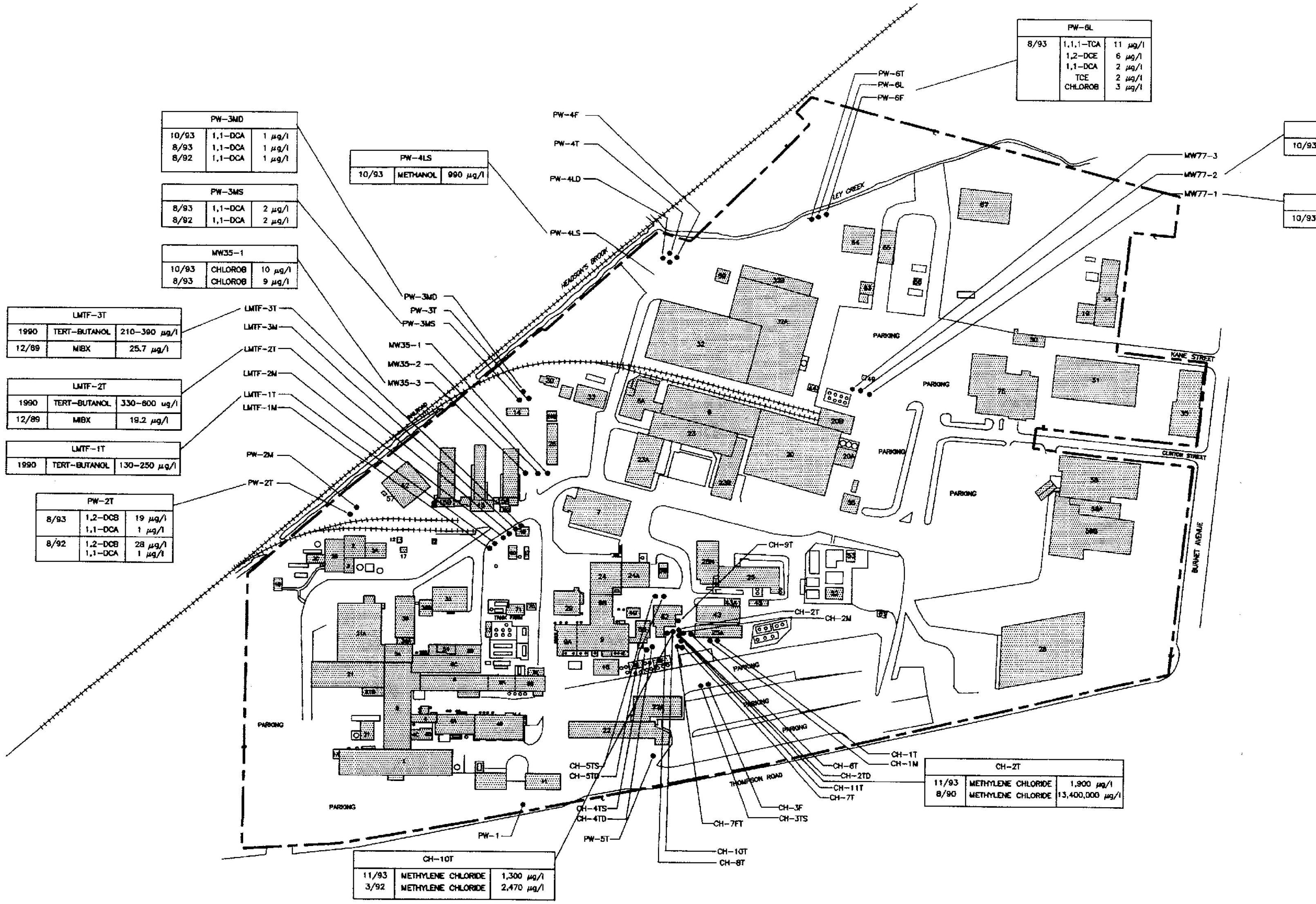
FIGURE 2.17



LEGEND

— — —	PROPERTY LINE
•	MONITORING WELLS
10/93	SAMPLING DATE
1,2 DCB	PARAMETER DETECTED
1 µg/l	CONCENTRATION IN MICROGRAMS PER LITER (PARTS PER BILLION)

250' 0 250'
Approximate Scale in Feet

BRISTOL MYERS-SQUIBB COMPANY
THOMPSON ROAD FACILITY

SUMMARY OF GROUNDWATER SAMPLING RESULTS

ENGINEERING-SCIENCE
DESIGN • RESEARCH • PLANNING
SYRACUSE, NEW YORK

ES

DATE: 5/26/94
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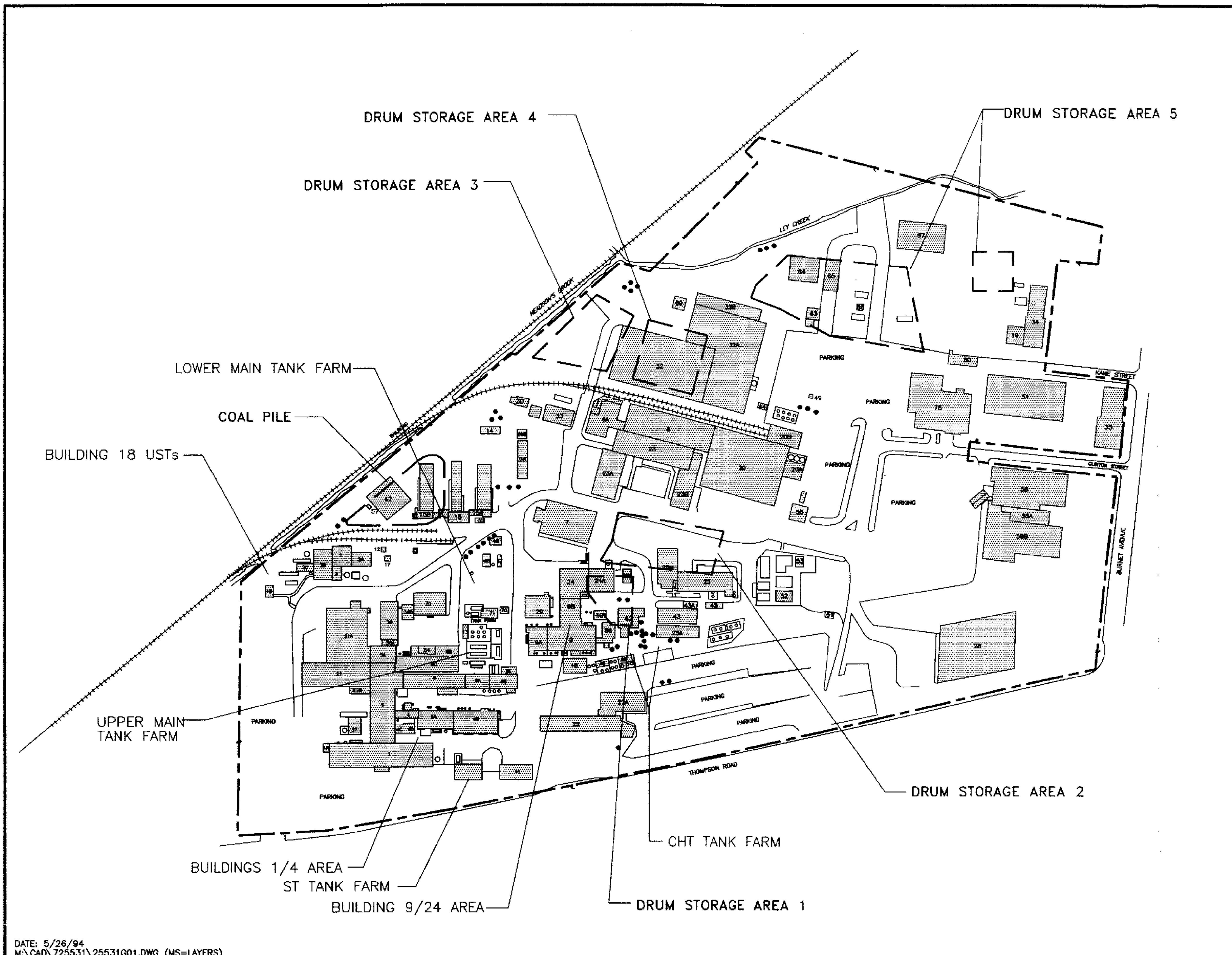
FIGURE 2.18



BRISTOL MYERS-SQUIBB COMPANY
THOMPSON ROAD FACILITY

POTENTIAL SOURCE AREA LOCATION MAP

ENGINEERING-SCIENCE
DESIGN • RESEARCH • PLANNING
SYRACUSE, NEW YORK
ES

DATE: 5/26/94
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SECTION 3

CONCLUSIONS AND RECOMMENDATIONS

3.1 ADEQUACY OF EXISTING INFORMATION

3.1.1 Assessment of Monitoring Well Conditions

Concrete pads should be installed at wells PW-4T, 4LS, 4LD and 4F. The concrete pad at well LMTF-3M was cracked and should be replaced. No apparent problems with the condition or integrity of the other wells was noted. Well pairs LMTF-1, LMTF-2 and LMTF-3 should be redeveloped as necessary prior to sampling.

3.1.2 Assessment of Monitoring Well Locations

Site monitoring wells are screened in the shallow fill and lacustrine units as well as the deeper till deposits. The locations of these wells can be used to evaluate groundwater conditions across the entire site and near Study Areas.

Major preferential pathways at the site have been identified and consist of the sanitary and storm sewer bedding material. Well clusters PW-3 and PW-6 are located adjacent to the downgradient portions of sanitary Trunklines 5 and 7 which convey large quantities of process wastewater. These lines also run parallel to storm sewer Outfalls 003 and 007 which may provide preferential pathways for contaminant migration. Notch well nests MW-35-1,2 and 3 and MW-77-1, 2 and 3 are located within the bedding material of the storm and sanitary sewers along Outfalls 003 and 007 where integrity losses have been identified. These wells are located along the downgradient portions of the sewers and should provided an indication of whether the bedding material is acting as a major pathway. Additional geoprobe sampling is planned along numerous deteriorated sections of sanitary sewer Trunklines 1, 5 and 7 as part of the Storm Sewer Contaminant Source Investigation (see Section 4).

Outfalls 002 and 009 sewer bedding may provide a preferential pathway for contaminant migration from processing areas, sanitary sewers, and former drum storage locations. Therefore, geoprobe samples will be collected from the bedding material at the downgradient end of Outfalls 002 and 009 (see Section 4, Figure 4.1).

3.1.3 Assessment of Existing Analytical Data

During the course of the previous investigations, on-site monitoring wells have been sampled for the major solvents used at the facility. Samples were reportedly collected in accordance with proper sampling procedures. Although the data were not validated, most of the data are consistent and are valid and usable. However, two types of inconsistencies were identified. These include: compounds that were only detected in one sample but were not detected in previous or subsequent samples, and compounds that were detected in one well but were not detected in adjacent wells or any other on-site wells. Specific examples of these are as follows:

- Methanol was detected in one groundwater sample from perimeter well PW-4LS during October 1993. Methanol was not detected in the previous three samples.

Methanol was also not detected in a subsequent sample collected in December 1993.

- Acetone was detected in only one sample from notch well MW77-2 at a concentration of 190 $\mu g/l$. Acetone was not detected in the two adjacent wells or in any of the other on-site wells or the perimeter wells.
- Low concentrations of 1,1,1-TCA and 1,2-DCE were detected in one groundwater sample from perimeter well PW-6L during August 1993. No VOCs were detected in the October 1993 groundwater sample.
- Chlorobenzene and 1,2-dichlorobenzene were each detected in one well at low concentrations. They were not detected in the adjacent wells or any other on-site wells.

In areas such as the Upper and Lower Main Tank Farm, the CHT Tank Farm and former drum storage area 1, adequate data have been collected to reach a conclusion on the presence or absence of contamination at levels of environmental concern. Those areas where adequate information is not available were identified as study areas. Additional data will be collected from these areas during the SIRS or Storm Sewer Contaminant Source Investigation.

3.2 CONCLUSIONS

Based on results of the Site Contamination Study, the following conclusions can be made:

- Historical development of the site began in the northwestern corner and expanded to the east and south. Major solvent usage areas were located in the northwest portion of the site and have remained in the same locations through time.
- No potential source areas of Study Areas are located in the southern portion of the site. This area consisted of open fields, residential homes, and parking areas until approximately 1980. It is currently occupied by administrative, receiving and traffic control, and research buildings.
- Five historic drum storage areas were identified at the site. Drums of chemicals were temporarily stored on the ground surface in these areas until they were used in the manufacturing process. The storage areas were relocated to the east as the site expanded.
- Available data do not indicate extensive contamination of groundwater beneath the site. In particular, the most commonly used chemicals at the site (acetone, MIBK, methanol, and butanol), with the exception of methylene chloride near the CHT Tank Farm, were not detected in the groundwater downgradient of major use areas. Where groundwater contamination is present near the CHT Tank Farm, it appears to be localized to a small area.
- The dual phase vacuum extraction pilot plant has proven to be capable of removing methylene chloride from the impacted area near the CHT Tank Farm. Since start-up, approximately 1,100 pounds of methylene chloride have been

removed. In addition, groundwater sampling indicates that the methylene chloride concentrations in the most contaminated extraction well, CH-2T, have decreased by an order of magnitude from an initial level of 13,200 mg/l to 1,900 mg/l in November 1993.

- Seven Study Areas have been identified which require additional information to determine the presence of contamination at levels of environmental concern. These include:

  1. Deteriorated sections of the sanitary sewer system (Includes areas in the vicinity of Outfalls 002 and 009)
  2. Building 1 and 4 area
  3. Building 9 and 24 area
  4. ST Tank Farm
  5. Former drum storage areas 2, 3, 4, 5
  6. Building 18 Fuel Oil USTs
  7. Former coal pile

- Groundwater data will be collected from four of the study areas as part of the Storm Sewer Contaminant Source Investigation. This information will be included in the SIRS report.

3.3 RECOMMENDATIONS

The following recommendations are made based on the data evaluated as part of this study:

1. Collection of two complete rounds of groundwater level measurements from all site wells is recommended to better characterize the groundwater flow systems and determine seasonal fluctuations.

2. Additional groundwater analytical data are needed from the seven study areas to determine if contamination may be present at levels of environmental concern. Groundwater samples will be obtained in each study area by using the Geoprobe or Hydropunch system. Samples may be analyzed using an on-site mobile laboratory unit equipped with a temperature-programable gas chromatograph or placed in a laboratory cooler, packed on ice and shipped overnight to a laboratory. Results from the groundwater samples will be used to assess the potential presence of a source area and the need, if any, for additional groundwater and soil sampling.

- Groundwater samples collected from the manufacturing and process areas, the chemical storage areas, and near the deteriorated sanitary sewers should be analyzed for parameters listed in Storm Sewer Contaminant Source Investigation Study.

- Groundwater samples from the petroleum storage area should be analyzed for BTEX and TCL semivolatile organic compounds.

- Groundwater samples from the former coal pile area should be analyzed for TCL semivolatile organic compounds.
- Number of samples and sample locations are presented in Section 4 the Site Investigation and Remediation Study Work Plan.

SECTION 4

SITE INVESTIGATION AND REMEDIATION STUDY WORK PLAN

4.1 SCOPE OF WORK

Based on the results of this investigation, additional sampling is recommended to further characterize the identified Study Areas. The data will be used to make a valid engineering judgment as to the presence of contamination at a level of environmental concern.

This Site Investigation and Remediation Study (SIRS) Work Plan presents a proposed scope of work to collect the needed data. The Work Plan also incorporates the sampling to be conducted as part of the Storm Sewer Contaminant Source Investigation. This information will be included in the SIRS report.

4.1.1 Task 1 - Groundwater Level Monitoring

Groundwater level elevations have been measured in the various on-site monitoring wells at different times during the various investigations. A complete round of groundwater level measurements from all on-site wells has not been conducted. In order to better define the vertical and horizontal flow systems and seasonal fluctuations, two complete rounds of groundwater level measurements will be conducted for all on-site monitoring wells. Static water levels will be measured from the rim of the casing with an electronic water level indicator to the nearest 0.01 feet and recorded.

Groundwater contour elevation maps will be prepared for the fill/glacio-lacustrine unit and the deeper till unit.

4.1.2 Task 2 - Geoprobe Sampling and Analysis

To further investigate if contaminants may be present at levels of environmental concern in the Study Areas identified during the Site Contamination Study, the Geoprobe System will be used to collect groundwater samples. Samples may be analyzed using an on-site mobile laboratory unit equipped with a temperature-programable gas chromatograph or placed in a laboratory cooler, packed on ice and shipped overnight to a laboratory. Groundwater sampling results will be used to assess the potential presence of a source area and the need, if any, for additional groundwater and soil sampling.

Sampling locations are identified on Figure 4.1 and discussed in the following section. Samples to be collected during the Storm Sewer Contaminant Source Investigation are also identified on Figure 4.1.

4.1.2.1 Manufacturing and Process Areas

Deteriorated Sections Along the Sanitary Sewers

Deteriorated pipe sections along sanitary sewer Trunklines 1,5,7, and 8 will be investigated during the Storm Sewer Contaminant Source Investigation Study.

Geoprobe points will be used to collect groundwater samples near the deteriorated sections. Several of these sections are located near Study Areas identified in the Site Contamination Study. The proposed sampling locations are identified on Figure 4.1. Samples will be analyzed for the following parameters:

pH
Chemical Oxygen Demand (COD)
Phenolics, total
Sulfate (as SO_4)
Nitrogen, Ammonia (as N)
Phosphorus, total
Molybdenum, total
Butanol
Dicyclohexylamine (DCHA)
Dimethylaniline (DMA)
Isobutanol*
Isopropanol
Methanol
Acetone
Methylene Chloride
MIBK
Toluene

* Isobutanol will be used as an indicator for isobutylchloroformate (IBCF). Isobutanol is a breakdown component of IBCF which is unstable in water.

In addition to the above parameters, three probe points located along the sanitary sewer between S5-14 and S5-15, will also be analyzed for chlorobenzene. Chlorobenzene was detected at low concentrations (9 μg/l and 10 μg/l) in two samples from nearby well MW-35-1. One probe point located approximately 50 feet downgradient of monitoring wells LMTF-1, 2 and 3 will also be analyzed for tert-butanol.

<u>Deteriorated Sections of Sanitary Sewer in the Vicinity of Outfalls 002 and 009</u>

Groundwater samples will also be collected along deteriorated sections of the sanitary sewers in the vicinity of Outfalls 002 and 009 (Figure 4.1). Samples will be collected in or as near as possible to the sewer bedding material using the geoprobe.

Samples will be collected from five locations along deteriorated sections of the sanitary sewer in the vicinity of Outfall 002. These include: two probe points between S1-1 and S1-3, one probe point between S1-6 and S1-7, one probe point near S2-1, and one probe point near the termination of Outfall 002. Samples will be analyzed for parameters listed in the Storm Sewer Contaminant Source Investigation.

Groundwater samples will be collected from two locations along deteriorated sections of the sanitary sewer near Outfall 009. The probe points are located in the parking lot west of Building 75. In addition, one groundwater sample will be collected from a probe point located near the termination of Outfall 009. Samples will be analyzed for parameters listed in the Storm Sewer Contaminant Source Investigation.

Building 1 and 4 Area

Groundwater samples will be collected with the Geoprobe from eight locations in the Building 1 and 4 areas during the Storm Sewer Contaminant Source Investigation Study. These include: two probe points along the deteriorated sewer line between manholes S1-21 to S1-A, two probe points between S1-13 and S1-15, two probe points near S5-48, one probe point between S5-45 to S5-47, and one probe point near S5-43 and the "4B" sump. If contamination is detected, additional probe points may be collected downgradient of this area. Samples will be analyzed for the parameters listed in the Storm Sewer Contaminant Source Investigation.

Building 9 and 24 Area

Groundwater samples will be collected with the Geoprobe from four locations in the Building 9 and 24 areas during the Storm Sewer Contaminant Source Investigation Study. These include: one probe point approximately 5 feet south of S5-26, and three probe points along the deteriorated sewer line between S7-13 and S7-11. If contamination is detected in these samples, additional probe points may be installed. Samples will be analyzed for the parameters listed in the Storm Sewer Contaminant Source Investigation.

4.1.2.2 Chemical Storage Areas

ST Tank Farm

Groundwater samples will be collected with the Geoprobe from two locations in the vicinity of the ST Tank Farm during the Storm Sewer Contaminant Source Investigation Study. The two probe points are located along the deteriorated sewer line between manholes S1-21 to S1-A. If contamination is detected, additional probe points may be collected downgradient of this area. Samples will be analyzed for the parameters listed in the Storm Sewer Contaminant Source Investigation.

Former Drum Storage Area 2

Two Geoprobe points will be installed during the SIRS to collect groundwater samples from within former drum storage area 2. In addition, five probe points will be installed along deteriorated sewers immediately downgradient of drum storage area 2 during the Storm Sewer Contaminant Source Investigation. Samples will be analyzed for the parameters listed in the Storm Sewer Contaminant Source Investigation.

Former Drum Storage Area 3

Two Geoprobe points will be installed during the SIRS to collect groundwater samples from within former drum storage area 3. Samples will be analyzed for the parameters listed in the Storm Sewer Contaminant Source Investigation.

Former Drum Storage Area 4

One Geoprobe point will be installed during the SIRS to collect a groundwater sample from within former drum storage area 4. The sample will be collected near the northeast corner of Building 32 which was constructed over most of the former drum storage area. Samples will be analyzed for the parameters listed in the Storm Sewer Contaminant Source Investigation.

Former Drum Storage Area 5

Three Geoprobe points will be installed during the SIRS to collect groundwater samples within former drum storage area 5. The two samples within the larger storage area will also be located within or as near as possible to the sewer bedding of Outfalls 007 and 008. In addition, one sample will be collected downgradient of the drum storage area adjacent to Outfall 009 during the Storm Sewer Contaminant Source Investigation. One sample will be collected from within the smaller area. Samples will be analyzed for the parameters listed in the Storm Sewer Contaminant Source Investigation.

4.1.2.3 Petroleum Storage Areas

Building 18 Fuel Oil USTs

Four Geoprobe points will be installed to collect groundwater samples in the vicinity of the former underground storage tanks. Two of these samples will be located immediately downgradient of the two sets of tanks (Tanks 2,3,4 and 5). One Geoprobe point will be installed immediately downgradient from Tank Oil 1 and one probe will be installed immediately downgradient of Tank Oil 2. Samples will be analyzed for benzene, toluene, ethylbenzene and xylene (BTEX) and TCL semivolatile organic compounds. Groundwater sampling results will be used to assess the potential presence of a source area and the need, if any, for additional groundwater and soil sampling.

4.1.3 Task 3 - Groundwater Sampling

4.1.3.1 Former Coal Pile

Groundwater samples will be collected from perimeter monitoring wells PW-2M and PW-2T which are located near the former coal pile. Samples will be analyzed for TCL semivolatile organic compounds.

A groundwater sample will also be collected from upgradient monitoring well PW-5T. The sample will be analyzed for TCL volatile and semivolatile organic compounds and TAL metals to better characterize the upgradient groundwater quality. Based on the groundwater flow directions, history of the surrounding properties, and previous analytical data, it is unlikely that significant contaminants have migrated on-site from adjacent properties.

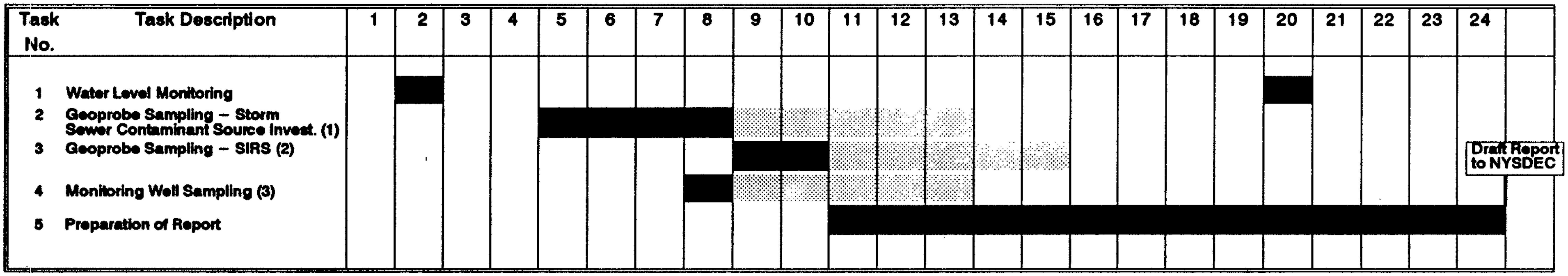
Field procedures and methodologies are detailed in the Field Sampling Plan (Appendix A). Sample custody, laboratory procedures, and other quality assurance and quality control requirements are specified in the Quality Assurance Project Plan (QAPP) in Appendix B. All field activities will be conducted in accordance with the site specific Health and Safety Plan (Appendix C).

4.2 PROJECT SCHEDULE

The proposed project schedule is shown in Figure 4.2. The schedule for the SIRS is dependent on receiving results from the Storm Sewer Contaminant Source Investigation. The schedule for completion of the field work is dependent on winter weather conditions.

FIGURE 4.2
PROJECT SCHEDULE
SITE INVESTIGATION AND REMEDIATION STUDY

Schedule in Weeks



Notes

The SIRS will be initiated within 60 days of receipt of approval of the Site Contamination Study Report.
The schedule is dependent on the start of sampling and receipt of data from the Storm Sewer Contaminant Source Investigation
(1) The start of sampling may be delayed until April/May 1995 depending on the weather
(2) Geoprobe sampling will be conducted in conjunction with the Storm Sewer Contaminant Source Investigation Sampling
(3) Groundwater sampling may be conducted in conjunction with the perimeter well sampling program

= Full Time Activity

= Laboratory Analysis (Analysis time may be reduced if an on–site mobile laboratory is used.

FIGURE 2.1

PROVIDED UNDER SEPARATE COVER